FINAL

ENVIRONMENTAL IMPACT REPORT

APPENDICES

Trail Change in Use and Improvement Project
Samuel P. Taylor State Park

September 2012

Lead Agency

Brad Michalk

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State of California
DEPARTMENT OF PARKS AND RECREATION
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Appendix A

Clearwater Hydrology Report

CLEARWATER HYDROLOGY

Consultants in Hydrology and Water Resources

Watershed Management

Stream and Wetland Restoration

Wetland Delineation and Permit Acquisition

Stormwater Drainage and Flooding

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June 23, 2009

Rachel Hooper, Esq.
Shute, Mihaly & Weinberger LLP
396 Hayes Street
San Francisco, CA 94102

RE: Erosion and Sediment Yield Impact Assessment for the Bill's Trail Use Conversion Project, Samuel P. Taylor State Park, Marin County, CA

Dear Ms. Hooper,

At your request, Clearwater Hydrology conducted the referenced impact assessment for Bill's Trail in Samuel P Taylor State Park. A location map of the Devil's Gulch and Bill's Trail area is presented in Figure 1. The California Department of Parks and Recreation (DPR) proposes to enact a use conversion project for Bill's Trail which would widen and/or reconstruct much of the trail and expand the existing single-use (hiking) to mountain biking and equestrian uses. The trail modification project was presented in a DPR memorandum, dated Jan. 25, 2008 and in DPR's Project Evaluation Form. Attachments to these documents included a *Change in Use Survey, Trail Matrix Classification*, and *Trail Log*, as well as portions of DPR's *Trail Project Implementation and Best Management Protocols*. In a filing with the State Clearinghouse in May 2009, DPR submitted a Notice of Exemption for the proposed trail modifications project under the title of "Bill's Trail Modifications".

The present erosion and sediment yield impact assessment seeks to determine whether the proposed trail modifications could have a detectable impact on sediment yield to Devil's Gulch and Lagunitas Creek. Both of these creeks provide critical habitat for federally-listed, steelhead trout (*Onocorhynchus mykiss irideus*) and coho salmon (*Oncorhynchus kisutch*). Fine sediment control is a principal objective of the Lagunitas Creek Fisheries Management Plan (see www.marinwater.org/documents/) and its allied Sediment and Riparian Management Plan (Prunuske-Chatham 1997), prepared by the Marin Municipal Water District (MMWD), under the mandate of the California State Water Resources Control Board (SWRCB Order WR 95-17). Since the proposed trail modifications include extensive excavation (for widening), spoil reconfiguration (outsloping) and recompaction, and other constructed features (e.g. drainage dips, water bars, and structural pinch points), as well as the expansion in user groups, substantial opportunities exist for project-related increases in erosion and sediment yield. The precise extent and potential significance of such increases would only become evident with a more detailed investigation of the specific construction features and methods. Thus, the current assessment is necessarily cursory due to the lack of specific design information for the trail modifications. Given the potential for erosion in a critical habitat area, it is our recommendation that DPR perform a thorough analysis of this issue prior to approving the project.

The present assessment consisted of a field reconnaissance of the approximately 3.75-mile trail, a review of pertinent technical literature, and a comparative analytical assessment of estimated soil loss for a selected trail segment adjoining the Devil's Gulch channel. Field notes and photo-documentation supplemented measurements of trail widths and slopes and trail-to-stream distances made using tapes, a hand level and scaled maps (USGS, Google Earth, and DPR).

Local Physiography and Slope Processes

Bill's Trail traverses primarily north-facing, upland slopes within the Devil's Gulch Watershed. Trail elevations range from roughly 200 ft. at the Devil's Gulch bridge crossing to 1,200 ft. at the Barnabe Fire Trail junction, just below Barnabe Peak. Trail grades range from nearly level to 11 percent, with the steepest segment occurring closest to the Devil's Gulch channel bed at a downslope distance of as little as 10-15 feet. Steep first and second order creeks draining similarly steep, forested slopes deliver sediment and debris to Devil's Gulch, which is aligned southwest-northeast. The trail alignment initially parallels the nearly vertical to vertical canyon walls formed by the main stem channel incision, and then turns gradually eastward and further from the channel. Once the trail begins a series of switchbacks, it is several hundred feet from the Devil's Gulch channel (Figure 2). Note that the reproduced DPR figure distorts the channel to trail distances and is therefore considered approximate.

The trail crosses two of Devil's Gulch's perennial tributaries numerous times, at designated bridge crossings Nos. 1-7. In addition, stabilized tributary crossings occur where perennial flow is absent. At these ephemeral channel crossings, log and rock cribbing structures have been installed to allow subsurface drainage and maintain drier track conditions. Since upslope sediment has buried the upstream face of the structures, it is likely that sediment and debris-laden flow does occasionally flow over the trail surface during higher intensity rainstorms. There was no evidence of recent trail overflows at these locations during the June field inspection.

The upland physiography, or landscape, is composed of the incised, lower order stream channels and intervening, often pronounced, secondary ridges and smaller spur ridges separating these streams. Topographic hollows or swales are often located upslope of the headwaters of many low order streams. Swales are often the sources of rapidly moving debris-flows during periods of prolonged rainfall, and they can be a major source of stream sediment and debris.

Large to small topographic benches or steppes of flatter gradient are scattered throughout the uplands of the Devil's Gulch Watershed. One significant bench occurs alongside the main stem channel, opposite a point 2,000 ft. or so upslope of the trailhead, occupying a stream terrace on the inside of a meander. The bench thins out in the upstream direction as the channel meander moves to the southern edge of the canyon. The benches or steppes located on the steeper mid-slopes of hillsides are typically of landslide origin.

Ongoing, erosive slope processes of variable rates (both temporally and spatially) are responsible for the development of the upland physiography and these processes also transport derived sediment to the upland channels (lower order streams). The lower order tributaries are often storage sites for upslope sediment. Delivery to the main stem channel occurs episodically in response to less frequent, more intense runoff-producing rainstorms and debris flows. In addition to slumps, earthflows, combined slumps-earthflows, and debris-flows, sediment moves downslope in response to downslope creep, overland sheet-wash, rutting-rilling, and, within the stream channels, gully head advancement and bank slumping.

In their dormant or suspended state of inactivity, such landslide features, particularly large, old, flatter slumps, become storage areas for sediment eroded from above by both natural erosion and trail/road-induced erosion. Broader, convex ridges are also common storage areas for eroded trail and hillslope sediments. Sediment stored in hillslope depositional zones may not reach stream channels for hundreds to thousands of years. However, eroded hillslope or trail sediment that is transported downslope for short distances to tributary or main stem channels may reach receiving waters in the course of a single storm event.

Trail Soil and Bedrock Characteristics

Figure 3 is a soil unit map that shows the soils present in the portion of the Devil's Gulch Watershed traversed by Bill's Trail (Web Soil Survey 2.2, National Cooperative Soil Survey). A single soil unit classified as Dipsea- Barnabe very gravelly loams, 50-75% slopes, underlies the entire trail alignment. These soils are derived from sandstone bedrock residuum, which is readily observable both on the trail cut-slopes and occasionally on the trail bed. The majority Dipsea unit occurs primarily on north- and east-facing hillslopes and in moist drainageways, while the Barnabe unit is found on ridges and convex slopes. Both soil units are characterized as well-drained with low available water capacity, and exhibit rapid runoff potential and a very high erosion hazard (USDA 1985). The Dipsea soils are typically 40 inches thick, while the Barnabe soils are shallow at 10-20 inches in thickness. For both of the component soils, the Soil Survey lists fine-grain percentages, including medium to fine sands, silts and clays (i.e. passing No. 40 sieve) ranging from approximately 25-50 percent.

The sandstone bedrock that outcrops along Bill's Trail is typically highly weathered, as shown in several photos in the photo appendix. Some outcrops are more resistant, where the surrounding decomposing material has been preferentially eroded. However, the bulk of the exposed material has decomposed to smaller fragments and gravel, embedded in a fine-grained matrix of sand and silt, with some clay. Both the upper profile soil and this bedrock residuum are readily erodible by hydraulic or mechanical forces when forming a trailside cut-slope.

Field Observations of Erosion Sources and Processes

CH Principal, William Vandivere, P.E., and staff environmental engineer, Margaret McKeon hiked the entire length of Bill's Trail on June 18, 2009. The principal erosion source areas and processes related to trail construction and use were determined to be:

- Localized slump failures along the nearly vertical trail cut-banks- These slump failures occur continuously along the steeper and higher cut-faces, particularly along the initial, steep segment of the trail and in the vicinity of tributary channel crossings. The slump material forms small fan deposits along the inslope edge of the trail, typically 1-1.5 ft.-high, at the angle of repose for the eroded material. At this toe of slope position, the deposits sometimes revegetate, lending rooting stability and buttressing the lower cut-slope.

- Longer, steep trail segments with unbroken slopes- While there are minor, short segments of trail further upslope in the vicinity of the switchback turns, the highest potential for trail erosion and sediment yield occurs over the lowest roughly 1,700 ft. of the trail where the channel slope was measured at 11.7 percent and the slope is essentially unbroken. No rilling or rutting was noted along the segment due to minor outsloping, however, the trail edge is coincident with the top of the ascending high bank of the Devil's Gulch channel. Thus, the sediment delivery ratio- the portion of eroded soil that actually reaches a channel- is close to 1.0, or 100%, denoting certain delivery of eroded sediment to the channel.

- Tributary channel crossings either bridged or stabilized- Channel crossings necessarily locate trail segments immediately adjacent to short, steep channel banks. Although in some cases, sediment may be stored in the receiving channel for some time prior to being conveyed further downstream to Devil's Gulch, the efficiency in sediment delivery to the active tributary channel is high.

- Access trail segment downslope of Bill's Trail- The trail modifications noted in the DPR documentation make no specific mention of the ultimate trail linkage with Sir Francis Drake. If the existing lower trail segment atop the bank of Devil's Gulch is used for this linkage, it will represent a ready source area for sediment yielded to the Devil's Gulch channel. Along portions of this segment, the edge of the existing trail is coincident with the top of vertical bank of the channel.

Assessment of Erosion and Sediment Yield Impacts Related to Bill's Trail Modifications and Use Conversion

Based on the June 2009 field reconnaissance, review of the documentation provided by DPR describing the trail modification and use conversion project, and simple CH computations of soil loss from the steep, lower segment of Bill's Trail, the findings of the erosion and sediment yield assessment yielded the following findings/conclusions:

1) Erosion and soil loss will increase following completion of construction due to the extent of disturbance to the trail bed and adjoining cut-slope for expansion of the trail prism- The DPR plan specifies the construction of a 4 ft.-wide trail bed with an unspecified extent of cut-slope excavation. A narrower trail width, typically 2-3 feet, but occasionally less, currently prevails over much of the trail length. These measured widths do not include the existing slough fans or the vegetated outer edges and/or minor fill berms. Fine sediments, representing up to 50% of the total soil volume, will be released during the excavation/expansion work and for the first year following construction; as fines are flushed from the surfaces, and adjoining areas have yet to revegetate and provide buffering capacity.

   Site-specific mitigations for minimizing sediment loss to steep slopes immediately adjacent to the Devil's Gulch channel or directly to tributary channels at trail crossings are necessary to minimize aquatic habitat impacts during this period.

2) Erosion and soil loss due to ongoing use of the reconfigured trail will result in increased sediment yield to the Devil's Gulch channel and its tributaries- After the trail has been reconfigured and immediate and short term, post-construction sediment has been transported downslope, trail segments will continue to experience increased soil loss relative to the existing condition. This is primarily due to the widened trail track and the more continual removal of sloughed sediments from the cut-slope.

   CH computed existing and post-project rates of soil loss for a portion of the steep (11.7%), lower trail segment fronting the main stem Devil's Gulch channel using the Universal Soil Loss Equation (USLE). The USLE was originally developed for farmland soil loss estimation by Wischmeier and Smith (1978), and was later adapted to construction sites and other contexts. Goldman (1986, 1991) presented regionalized maps and parameter values for application of the USLE to California. The equation, its parameter values, and supporting maps and tables are presented in Appendix B, which also includes a spreadsheet table showing the results of the analysis. CH analyzed a 50-ft. sub-segment of the selected 1,700 ft. trail segment to incorporate the likely use of water bars along this lengthy segment. The sub-segment soil loss total was then extrapolated over the longer 1,700 ft. trail segment.

   The USLE analysis resulted in an estimated 34 percent increase in soil loss over the 1,700 ft. trail segment due to the proposed trail conversion and widening. Similar computations could be made for the entire trail. Note also that this estimate only quantifies the potential soil loss from the reconfigured trail bed and not from incidental erosion of the cut-slope.

3) Cut-slope sloughing and dry ravel will continue along the reconfigured inslope edge of the trail bed, and the potential concurrent use by hikers, bikers and equestrians will likely result in continual disturbance and loss of the slough material- This could result in both the destabilization of the slough material, making it ready for detachment and mobilization by sheet runoff, and the loss of buttressing for the oversteepened cut-slope. Moreover, revegetation of the trail edges, as occurs under existing use conditions, will be highly unlikely. A negative feedback cycle could thus be established, producing an increase in erosion and sediment soil loss. This soil loss would yield increased sediment to Devil's Gulch and its tributary channels where downslope grades are steep and distances to drainageways are short.

4) Bike breaking and acceleration in the approaches to bridge crossings in wet conditions could lead to excessive soil shearing, and the development of ruts that concentrate surface runoff during rainstorms- Sediment-laden runoff in the vicinity of these bridge crossings has a short path to enter the forded tributary channels. These crossing approaches require targeted mitigation strategies that minimize the influx of sediment from the adjoining cut-slopes and provide well-drained conditions.

5) Expanded mixed-use of the trail segment downslope of Bill's Trail linking it to Sir Francis Drake (SFD) would potentially cause significant increases in trail erosion and direct transport of sediment to the Devil's Gulch channel- While this trail link has not been specified as part of the project, access to SFD would presumably be provided in some form. In some sub-segments of this trail reach, the outer edge of the trail bed is coincident with the top of the channel bank, which is vertical or even oversteepened beyond vertical.

6) Outside of the more sensitive trail links fronting on the Devil's Gulch channel and its tributaries (near bridge or other channel crossings) noted above, the existing trail is positioned on benched or stepped upland slopes that accord substantial opportunities for deposition and are far removed from the Devil's Gulch channel- Thus, these trail segments are more suitable for the increased volume of mixed-use traffic planned for the project.

Given the demonstrated potential for increased erosion and soil loss in a critical habitat area, it is our recommendation that DPR perform a thorough analysis of this issue prior to approving the project. We trust that this assessment will assist DPR and other interested parties in their evaluation of the Bill's Trail project and the submitted Notice of Exemption.

Yours truly,

William Vandivere, P.E.
Principal

Margaret McKeon, M.S.
Environmental Engineer

Attachments:

Appendix A: Photo-Documentation: CH Field Reconnaissance, June 2009

Appendix B: Soil Loss Estimates for Pre- and Post-Project Trail Conditions-Selected Near-Channel Reach

Appendix C: Supplemental Technical Data

REFERENCES and SELECTED BIBLIOGRAPHY

California Dept. of Parks and Recreation 1991. "Trails Handbook". The Resources Agency, Department of Parks and Recreation, Sacramento, CA.

Goldman, S. 1986. Erosion and Sediment Control Handbook. McGraw Hill, Inc.

Goldman, S. 1991. "Erosion Control and Land Restoration Course Handout", Prepared for UC Berkeley Extension, Sept. 27, 1991.

Griswold, S.S. 1996. "A Handbook on Trail Building and Maintenance for National, State and Local Natural Resource Agencies".

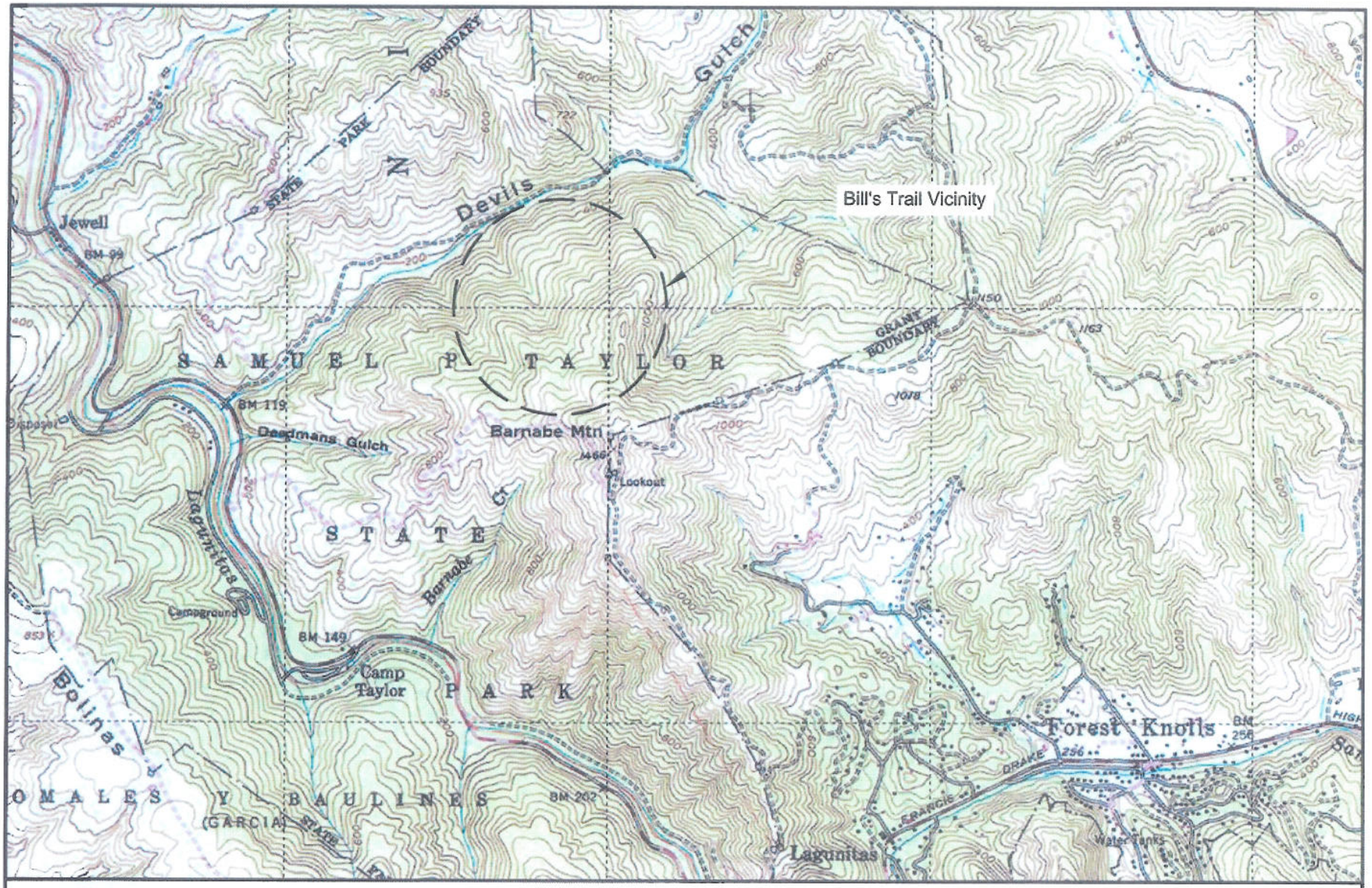
Lal, R. and W. Elliot 1994. Chapter 8, *Erodibility and erosivity.* In R. Lal (ed.) Soil Erosion Research Methods. USA: Soil and Water Conservation Society and St. Lucie Press.

Wischmeier, W.H. and D.D. Smith 1978. "Predicting Rainfall Erosion Losses- A Guide to Conservation Planning". USDA Agriculture Handbook 537.

APPENDICES

APPENDIX A:
Photo-Documentation:
CH Field Reconnaissance, June 2009

APPENDIX B:
Soil Loss Estimates for
Pre- and Post-Project Trail Conditions:
Selected Near-Channel Reach



CLEARWATER HYDROLOGY

2000 1000 0 2000

Scale in Feet

N

Figure 1 - Samuel P. Taylor State Park Regional Map

Project: Bill's Trail Improvement - Sediment Impact Appraisal
Date: 6/19/09

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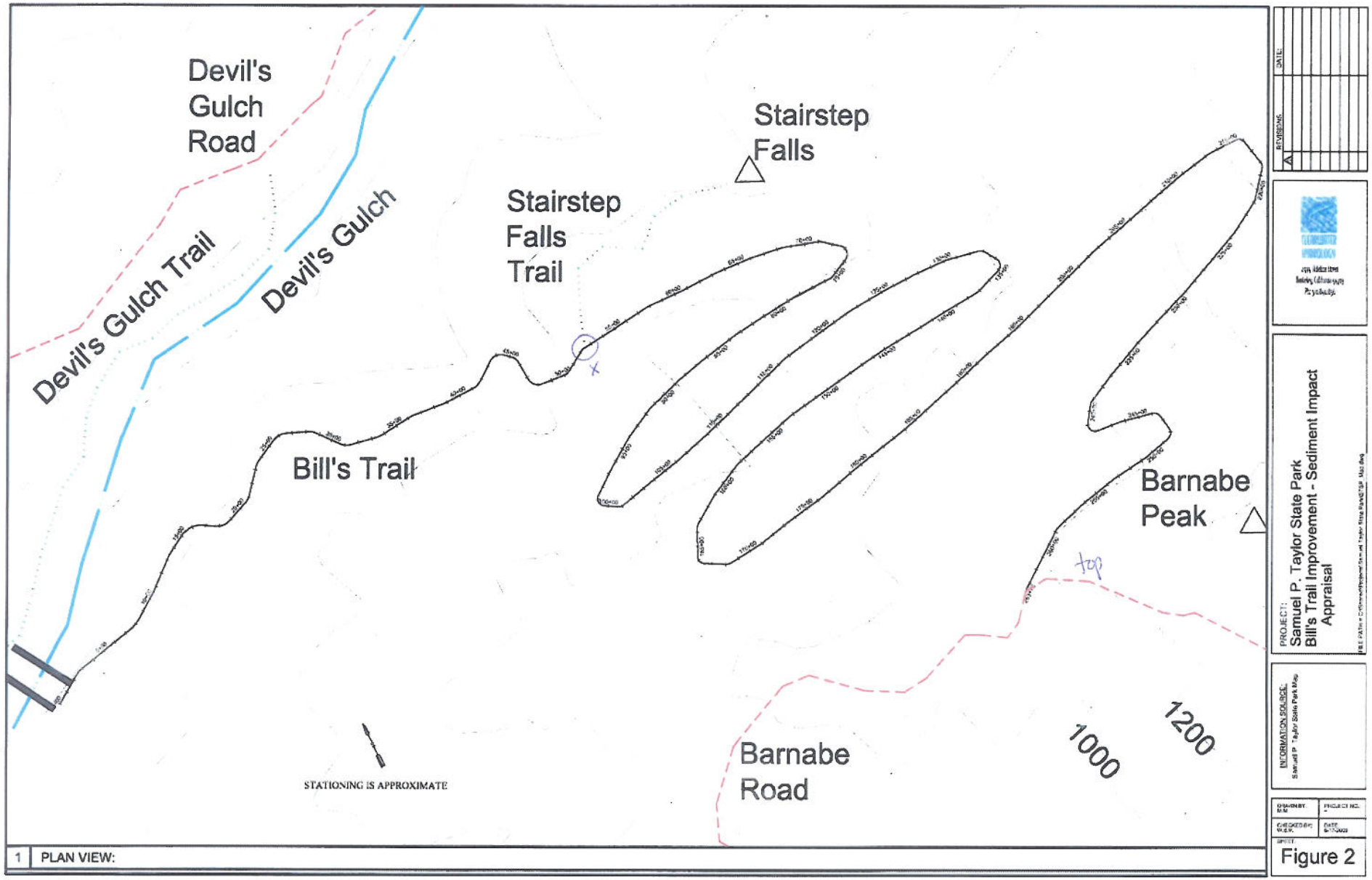
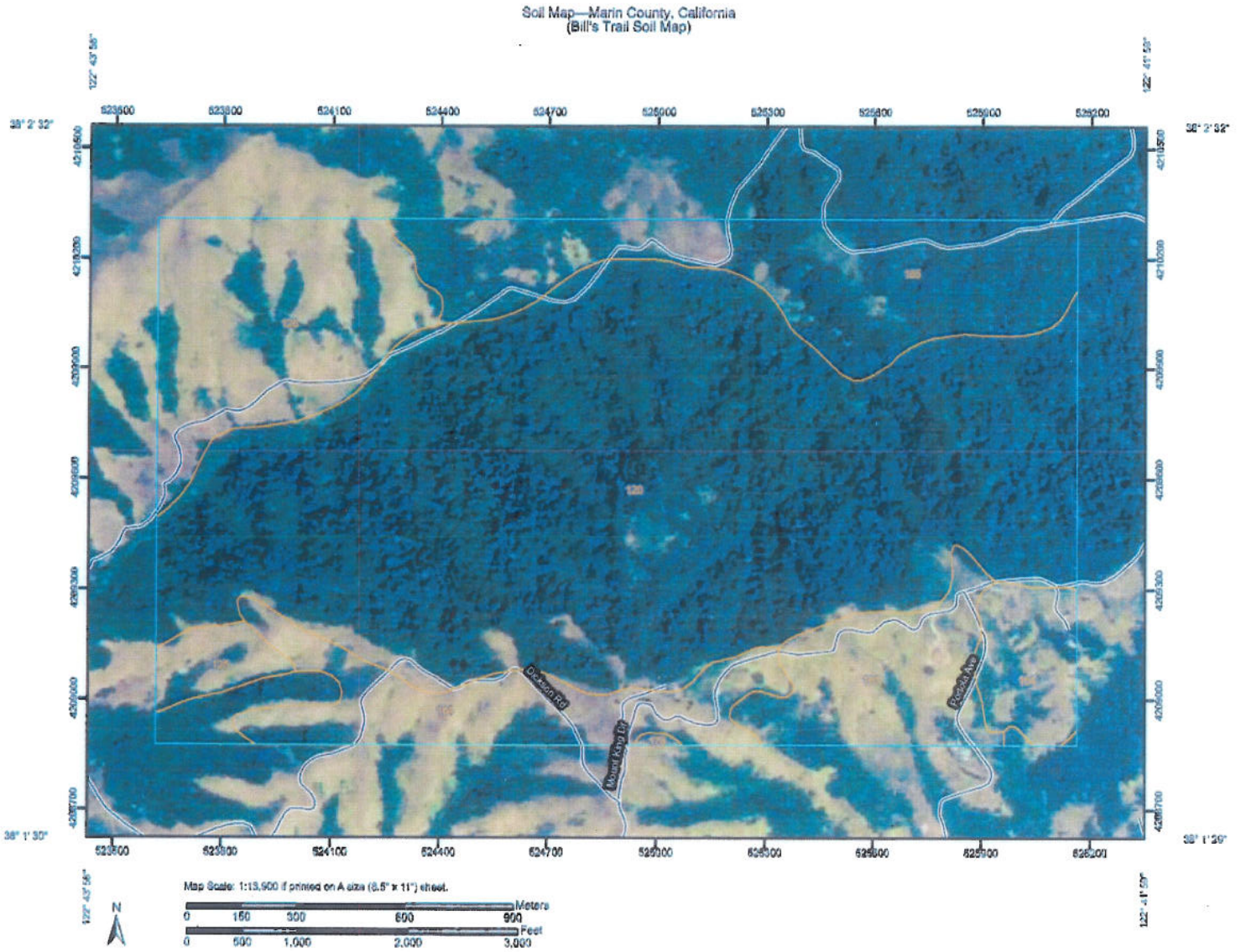


bridge

very diff trail from what is in PEF (brochure pic)

Roy to get trail GPS'd



CLEARWATER HYDROLOGY

Figure 3 - Samuel P. Taylor State Park Soil Map

Project: Bill's Trail Improvement - Sediment Impact Appraisal
Date: 6/19/09

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Photo 1. View of the head of Bill's Trail and bridge spanning Devil's Gulch. The trail is approximately 3 ft. wide and within 6 ft. of the creekbed (photo right).

Photo 2. Example of concentrated runoff on the upslope side of Bill's Trail causing a minor slump and sediment deposition at the toe of the bank.

Photo 3. Downslope extension of slump in Photo 2. The evidence of concentrated runoff ends near the tree where most of the remaining sediment is likely deposited.

Photo 4. Example of frequent exposure of sandstone in steep upslope banks. Exposed sandstone is common along the upslope bank. It is weathered and yields gravel-sized sediment.

Photo 5. Example of nearly vertical and unvegetated upslope banks common on the upslope edge of steeper segments of Bill's Trail. Note the fine-grained, upper soil profile, overlapping the weathered sandstone residuum.

Photo 6. View of bench between the toe of the slope and Devil's Gulch. This bench will likely trap most sediment from the section of Bill's Trail between Sta. 30+00 and 35+00.

Photo 7. Photo of cut logs placed on the downslope edge of Bill's Trail, probably resulting from the clearing of fallen trees. Note the fine sediment yielded from the trail track that has been deposited between the offset logs.

Photo 8. Another example of near vertical, unvegetated banks on the cut-slope along Bill's Trail.

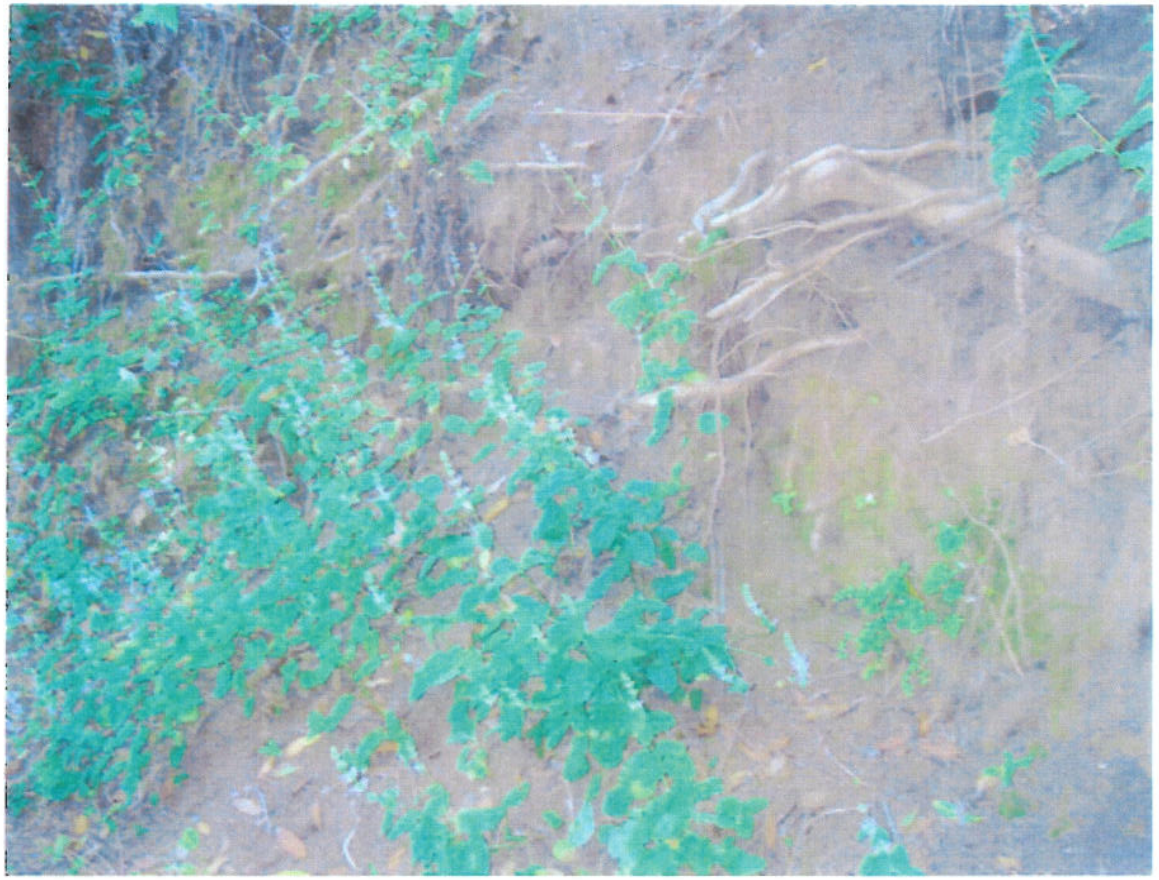


Photo 9. View of a typical alluvial fan (beneath flowers) formed along the toe of the upslope cut bank. Such fans are created by the action of upslope sheet flow, burrowing animals, and/or groundwater seepage. Under current conditions, portions of these fan deposits are vegetated, and both buttress the toe of the upper banks and reduce track soil loss.

Photo 10. View of narrow section of trail. Width shown is approximate 1-1.5' in width. This area would require significant widening.

Photo 11. View of Bridge #5. Widening the trail through this turn may be difficult.

Photo 12. Close-up view of Bridge #5. The supports are being scoured and exposed.

Photo 13. View of Bridge #6. The trail width is roughly 4 ft. here, compared to the narrower approaches at Bridge #5.

Photo 14. View of Barnabe Road looking upslope from Bill's Trail. The rut (photo left) continues for approximately 60-80 ft. up a steep section of the road (about 22% slope).

Table B1: USLE-Based Soil Loss Estimates For Bill's Trail Pre- and Post- Project Conditions for Bill's Trail Lower Segment Adjacent to Devil's Gulch Bridge Crossing

USLE:	A = R x K x LS x C x P					
	where	A =	soil loss		tons/acre/year	
		R =	rainfall erosion index		(100ft.)(tons/acre)(in/hr)	
		K =	soil erodibility factor		(tons/acres)/(unit R)	
		LS =	slope length and steepness factor		dimensionless	
		C =	vegetative cover factor		dimensionless	
		P =	erosion control practice factor		dimensionless	
	- Total Length of lower 11.7% slope trail segment = 1,700 ft.					
	- Assume DPR water bar installation @ 50 ft. intervals, so use slope length = 50 ft.					
R Factor						
	From Figure 5-5	(Goldman, SJ 1991)				
		R = 75.0	(100ft.)(tons/acre)(in/hr)			
K Factor						
	"Whole-soil" value from WebSoil Survey					
		K = 0.1				
LS Factor						
	From AutoCaD:					
		slope = 0.117				
	From Table 5.5	(Goldman, ibid.)				
		LS =	(65.41 x S^2/(s^2+10,000) + 4.46 x S/(s^2 +10,000)^0.5 + 0.065)(L/72.5)^m			
			S =	11.7	slope steepness (%)	
			L =	50	slope length (ft)	
			m =	0.5	0.5 (for slopes >5%)	
		LS = 1.2				

C Factor				
	From Table 5.6	(Goldman, ibid.)		
	C = 1.0	No cover since trail is un-vegetated.		
P Factor				
	From Table 5.7	(Goldman, ibid.)		
	P = 1.3	Trail is compacted and smooth		
Soil Loss Per Acre Per Year				
	A = 11.9	tons/acre/year		
Existing Area of Trail				
	Length =	50	ft	
	Width =	3	ft	
	Area =	150	sq.-ft.	
		0.003	acres	
Proposed Area of Trail				
	Length =	50	ft	
	Width =	4	ft	
	Area =	200	sq.-ft.	
		0.005	acres	

Conclusion	
	Soil Loss (tons/year) for 50-ft. sub-segment
Existing Trail	0.041
Proposed Trail	0.055
	Soil loss for entire 1,700-ft. segment
Existing Trail	1.390
Proposed Trail	1.854
	Increase in soil loss
50-ft. Segment	34.1%
1,700-ft. Segment	33.3%

EROSION CONTROL AND LAND RESTORATION
COURSE HANDOUT

Prepared for:

U.C. Berkeley Extension
September 27, 1991

by

Steven J. Goldman

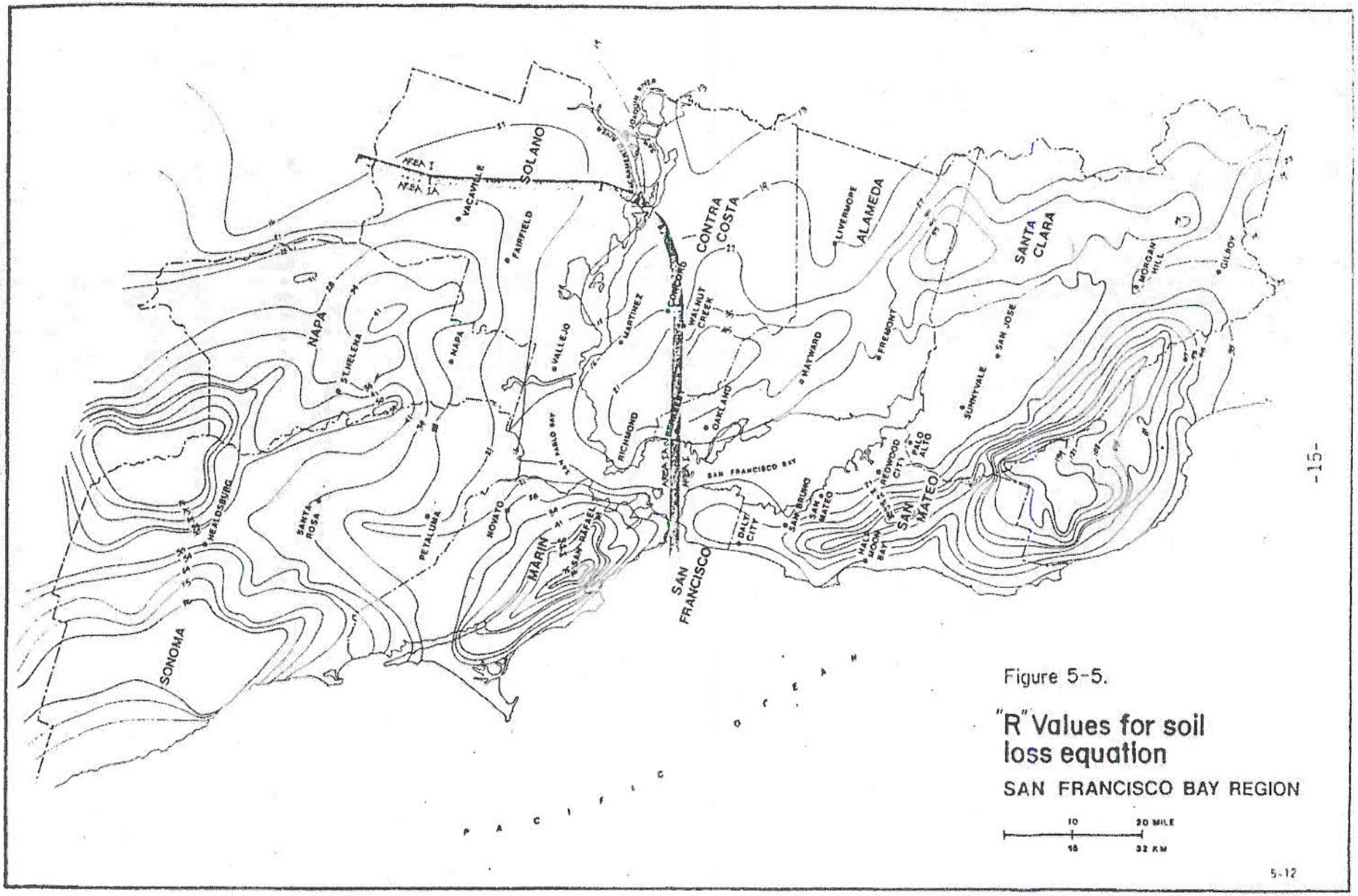


Figure 5-5.

"R" Values for soil loss equation

SAN FRANCISCO BAY REGION

5-12

5.2c Soil Erodibility Factor K

The soil erodibility factor K is a measure of the susceptibility of soil particles to detachment and transport by rainfall and runoff. Texture is the principal factor affecting K, but structure, organic matter, and permeability also contribute. K values range from 0.02 to 0.69.

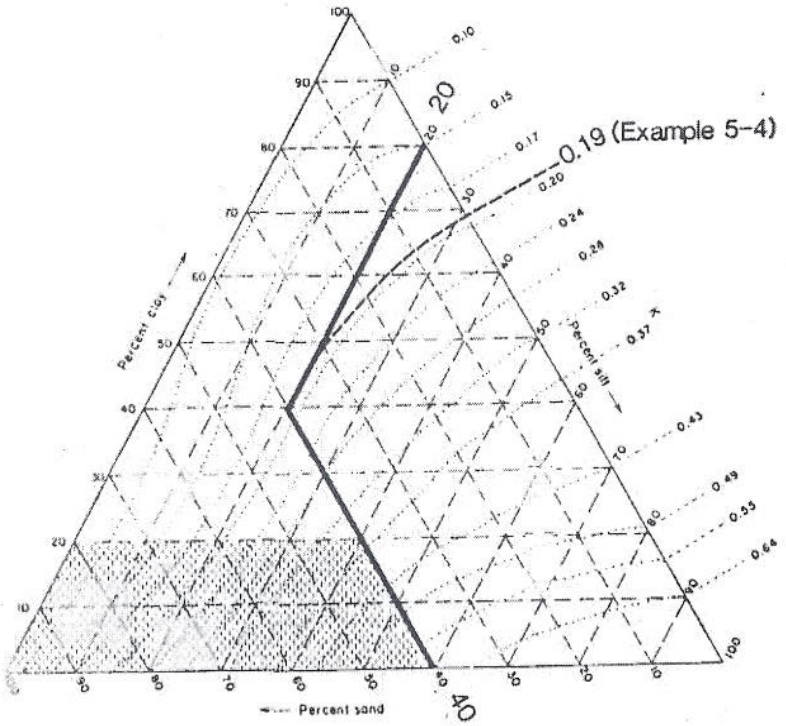


Fig. 5.6 Triangular nomograph for estimating K value. (6) See Table 5.3 for adjustments to K value under certain conditions.

EXAMPLE 5.4

Given: A soil with the following particle size distribution.

Component	Size, mm	Fraction, %
Sand	2.0–0.1	30
Very fine sand	0.1–0.05	10
Silt	0.05–0.002	20
Clay	Less than 0.002	40

Find: Texture and K value.

Solution: Entering Fig. 5.1 with 40 percent total sand and 20 percent silt, the texture is found to be on the border between clay and clay loam. Entering Fig. 5.6 with the same percents (see bold lines), the K value is found to be 0.19.

TABLE 5.6 C Values for Soil Loss Equation*

Type of cover	C factor	Soil loss reduction, %
None	1.0	0
Native vegetation (undisturbed)	0.01	99
Temporary seedings:		
90% cover, annual grasses, no mulch	0.1	90
Wood fiber mulch, ¼ ton/acre (1.7 t/ha), with seed†	0.5	50
Excelsior mat, jute†	0.3	70
Straw mulch†		
1.5 tons/acre (3.4 t/ha), tacked down	0.2	80
4 tons/acre (9.0 t/ha), tacked down	0.05	95

*Adapted from Refs. 11, 15, and 20

†For slopes up to 2:1.

TABLE 5.7 P Factors for Construction Sites (Adapted from Ref. 15)

Surface condition	P value
Compacted and smooth	1.3
Trackwalked along contour*	1.2
Trackwalked up and down slope†	0.9
Punched straw	0.9
Rough, irregular cut	0.9
Loose to 12-in (30-cm) depth	0.8

*Tread marks oriented up and down slope.

†Tread marks oriented parallel to contours, as in Figs. 6.9 and 6.10.

TABLE 5.5 (LS Values) (10)

Slope ratio	Slope gradient, %	LS values for following slope lengths *l*, ft (m)									
		10 (3.0)	20 (6.1)	30 (9.1)	40 (12.2)	50 (15.2)	60 (18.3)	70 (21.3)	80 (24.4)	90 (27.4)	100 (30.5)
	0.5	0.06	0.07	0.07	0.08	0.08	0.09	0.09	0.09	0.09	0.10
100:1	1	0.08	0.09	0.10	0.10	0.11	0.11	0.12	0.12	0.12	0.12
	2	0.10	0.12	0.14	0.15	0.16	0.17	0.18	0.19	0.19	0.20
	3	0.14	0.18	0.20	0.22	0.23	0.25	0.26	0.27	0.28	0.29
	4	0.16	0.21	0.25	0.28	0.30	0.33	0.35	0.37	0.38	0.40
20:1	5	0.17	0.24	0.29	0.34	0.38	0.41	0.45	0.48	0.51	0.53
	6	0.21	0.30	0.37	0.43	0.48	0.52	0.56	0.60	0.64	0.67
	7	0.26	0.37	0.45	0.52	0.58	0.64	0.69	0.74	0.78	0.82
12½:1	8	0.31	0.44	0.54	0.63	0.70	0.77	0.83	0.89	0.94	0.99
	9	0.37	0.52	0.64	0.74	0.83	0.91	0.98	1.05	1.11	1.17
10:1	10	0.43	0.61	0.75	0.87	0.97	1.06	1.15	1.22	1.30	1.37
	11	0.50	0.71	0.86	1.00	1.12	1.22	1.32	1.41	1.50	1.58
8:1	12.5	0.61	0.86	1.05	1.22	1.36	1.49	1.61	1.72	1.82	1.92
	15	0.81	1.14	1.40	1.62	1.81	1.98	2.14	2.29	2.43	2.56
6:1	16.7	0.96	1.36	1.67	1.92	2.15	2.36	2.54	2.72	2.88	3.04
5:1	20	1.29	1.82	2.23	2.58	2.88	3.16	3.41	3.65	3.87	4.08
4½:1	22	1.51	2.13	2.61	3.02	3.37	3.69	3.99	4.27	4.53	4.77
4:1	25	1.86	2.63	3.23	3.73	4.16	4.56	4.93	5.27	5.59	5.89
	30	2.51	3.56	4.36	5.03	5.62	6.16	6.65	7.11	7.54	7.95
3:1	33.3	2.98	4.22	5.17	5.96	6.67	7.30	7.89	8.43	8.95	9.43
	35	3.23	4.57	5.60	6.46	7.23	7.92	8.55	9.14	9.70	10.22
2½:1	40	4.00	5.66	6.93	8.00	8.95	9.80	10.59	11.32	12.00	12.65
	45	4.81	6.80	8.33	9.61	10.75	11.77	12.72	13.60	14.42	15.20
2:1	50	5.64	7.97	9.76	11.27	12.60	13.81	14.91	15.94	16.91	17.82
	55	6.48	9.16	11.22	12.96	14.48	15.87	17.14	18.32	19.43	20.48
1¾:1	57	6.82	9.64	11.80	13.63	15.24	16.69	18.03	19.28	20.45	21.55
	60	7.32	10.35	12.68	14.64	16.37	17.93	19.37	20.71	21.96	23.15
1½:1	66.7	8.44	11.93	14.61	16.88	18.87	20.67	22.32	23.87	25.31	26.68
	70	8.98	12.70	15.55	17.96	20.08	21.99	23.75	25.39	26.93	28.39
	75	9.78	13.83	16.94	19.56	21.87	23.95	25.87	27.66	29.34	30.92
1¼:1	80	10.55	14.93	18.28	21.11	23.60	25.85	27.93	29.85	31.66	33.38
	85	11.30	15.98	19.58	22.61	25.27	27.69	29.90	31.97	33.91	35.74
	90	12.02	17.00	20.82	24.04	26.88	29.44	31.80	34.00	36.06	38.01
	95	12.71	17.97	22.01	25.41	28.41	31.12	33.62	35.94	38.12	40.18
1:1	100	13.36	18.89	23.14	26.72	29.87	32.72	35.34	37.78	40.08	42.24

*Calculated from

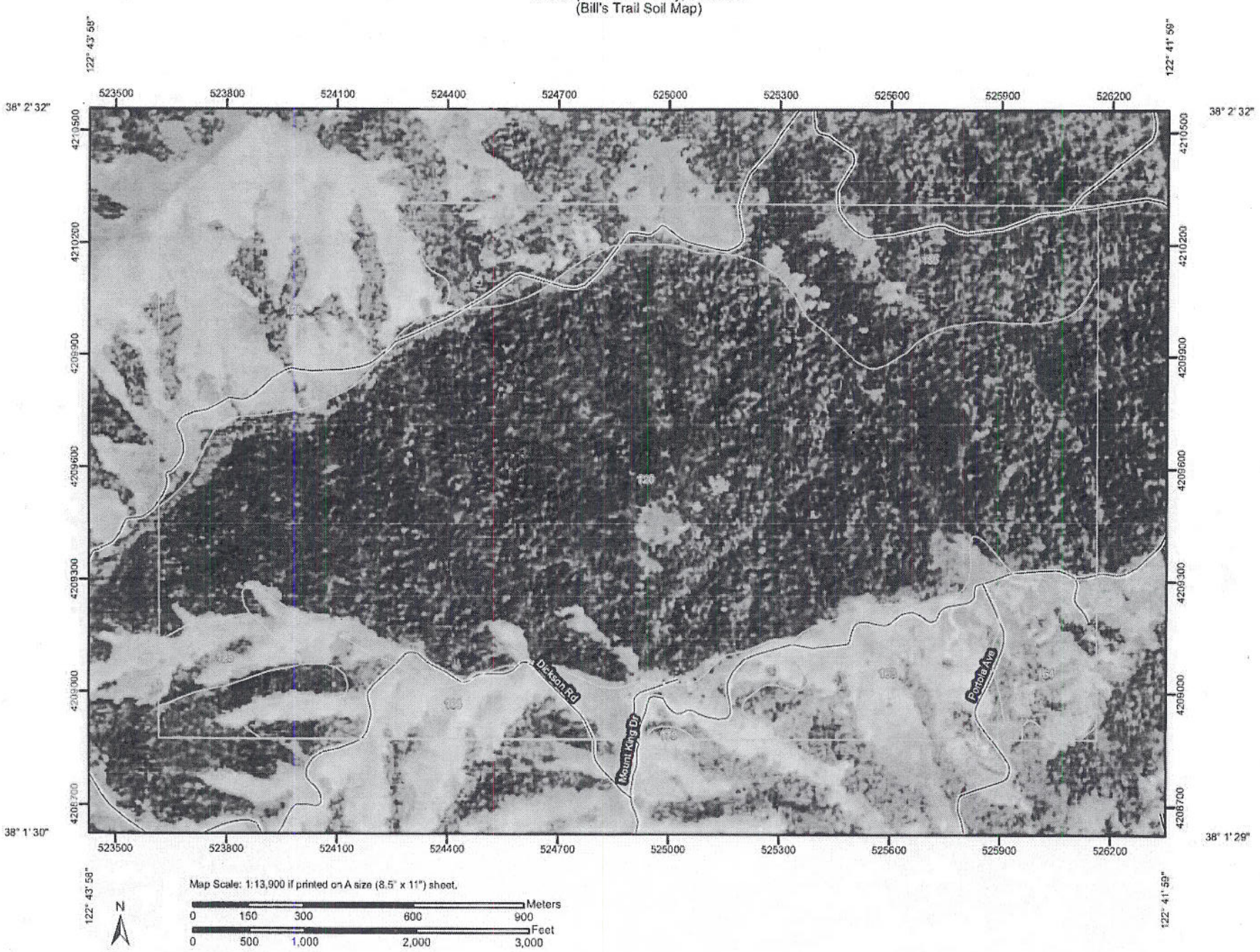
$$LS = \left(\frac{65.41 \times s^2}{s^2 + 10{,}000}\right) + \left(\frac{4.56 \times s}{\sqrt{s^2 + 10{,}000}}\right) + 0.065\left)\left(\frac{l}{72.5}\right)^m$$

LS = topographic factor
l = slope length, ft (m × 0.3048)
s = slope steepness,
m = exponent dependent upon slope steepness
(0.2 for slopes < 1%, 0.3 for slopes 1 to 3%
0.4 for slopes 3.5 to 4.5%, and
0.5 for slopes ≥ 5%)

LS values for following slope lengths *l*, ft (m)												
150 (46)	200 (61)	250 (76)	300 (91)	350 (107)	400 (122)	450 (137)	500 (152)	600 (183)	700 (213)	800 (244)	900 (274)	1000 (305)
0.10	0.11	0.11	0.12	0.12	0.13	0.13	0.13	0.14	0.14	0.14	0.15	0.15
0.14	0.14	0.15	0.16	0.16	0.16	0.17	0.17	0.18	0.18	0.19	0.19	0.20
0.23	0.25	0.26	0.28	0.29	0.30	0.32	0.33	0.34	0.36	0.37	0.39	0.40
0.32	0.35	0.38	0.40	0.42	0.43	0.45	0.46	0.49	0.51	0.54	0.55	0.57
0.47	0.53	0.58	0.62	0.66	0.70	0.73	0.76	0.82	0.87	0.92	0.96	1.00
0.66	0.76	0.85	0.93	1.00	1.07	1.13	1.20	1.31	1.42	1.51	1.60	1.69
0.82	0.95	1.06	1.16	1.26	1.34	1.43	1.50	1.65	1.78	1.90	2.02	2.13
1.01	1.17	1.30	1.43	1.54	1.65	1.75	1.84	2.02	2.18	2.33	2.47	2.61
1.21	1.40	1.57	1.72	1.85	1.98	2.10	2.22	2.43	2.62	2.80	2.97	3.13
1.44	1.66	1.85	2.03	2.19	2.35	2.49	2.62	2.87	3.10	3.32	3.52	3.71
1.68	1.94	2.16	2.37	2.56	2.74	2.90	3.06	3.35	3.62	3.87	4.11	4.33
1.93	2.23	2.50	2.74	2.95	3.16	3.35	3.53	3.87	4.18	4.47	4.74	4.99
2.35	2.72	3.04	3.33	3.59	3.84	4.08	4.30	4.71	5.08	5.43	5.76	6.08
3.13	3.62	4.05	4.43	4.79	5.12	5.43	5.72	6.27	6.77	7.24	7.68	8.09
3.72	4.30	4.81	5.27	5.69	6.08	6.45	6.80	7.45	8.04	8.60	9.12	9.62
5.00	5.77	6.45	7.06	7.63	8.16	8.65	9.12	9.99	10.79	11.54	12.24	12.90
5.84	6.75	7.54	8.26	8.92	9.54	10.12	10.67	11.68	12.62	13.49	14.31	15.08
7.21	8.33	9.31	10.20	11.02	11.78	12.49	13.17	14.43	15.58	16.66	17.67	18.63
9.74	11.25	12.57	13.77	14.88	15.91	16.87	17.78	19.48	21.04	22.49	23.86	25.15
11.55	13.34	14.91	16.33	17.64	18.86	20.00	21.09	23.10	24.95	26.67	28.29	29.82
12.52	14.46	16.16	17.70	19.12	20.44	21.68	22.86	25.04	27.04	28.91	30.67	32.32
15.50	17.89	20.01	21.91	23.67	25.30	26.84	28.29	30.99	33.48	35.79	37.96	40.01
18.62	21.50	24.03	26.33	28.44	30.40	32.24	33.99	37.23	40.22	42.99	45.60	48.07
21.83	25.21	28.18	30.87	33.34	35.65	37.81	39.85	43.66	47.16	50.41	53.47	56.36
25.09	28.97	32.39	35.48	38.32	40.97	43.45	45.80	50.18	54.20	57.94	61.45	64.78
26.40	30.48	34.08	37.33	40.32	43.10	45.72	48.19	52.79	57.02	60.96	64.66	68.15
28.35	32.74	36.60	40.10	43.31	46.30	49.11	51.77	56.71	61.25	65.48	69.45	73.21
32.68	37.74	42.19	46.22	49.92	53.37	56.60	59.66	65.36	70.60	75.47	80.05	84.38
34.77	40.15	44.89	49.17	53.11	56.78	60.23	63.48	69.54	75.12	80.30	85.17	89.78
37.87	43.73	48.89	53.56	57.85	61.85	65.60	69.15	75.75	81.82	87.46	92.77	97.79
40.88	47.20	52.77	57.81	62.44	66.75	70.80	74.63	81.76	88.31	94.41	100.13	105.55
43.78	50.55	56.51	61.91	66.87	71.48	75.82	79.92	87.55	94.57	101.09	107.23	113.03
46.55	53.76	60.10	65.84	71.11	76.02	80.63	84.99	93.11	100.57	107.51	114.03	120.20
49.21	56.82	63.53	69.59	75.17	80.36	85.23	89.84	98.42	106.30	113.64	120.54	127.06
51.74	59.74	66.79	73.17	79.03	84.49	89.61	94.46	103.48	111.77	119.48	126.73	133.59

APPENDIX C:
Supplemental Technical Data

Soil Map—Marin County, California
(Bill's Trail Soil Map)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:13,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 10N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Marin County, California
Survey Area Data: Version 5, Dec 10, 2007

Date(s) aerial images were photographed: 6/12/2005

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Marin County, California (CA041)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
120	DIPSEA-BARNABE VERY GRAVELLY LOAMS, 50 TO 75 PERCENT SLOPES	525.0	58.3%
125	FELTON VARIANT-SOULAJULE COMPLEX, 30 TO 50 PERCENT SLOPES	14.2	1.6%
126	FELTON VARIANT-SOULAJULE COMPLEX, 50 TO 75 PERCENT SLOPES	97.3	10.8%
163	SAURIN-BONNYDOON COMPLEX, 30 TO 50 PERCENT SLOPES	55.1	6.1%
164	SAURIN-BONNYDOON COMPLEX, 50 TO 75 PERCENT SLOPES	92.9	10.3%
179	TOCALOMA-MCMULLIN COMPLEX, 30 TO 50 PERCENT SLOPES	0.8	0.1%
185	TOCALOMA-SAURIN ASSOCIATION, EXTREMELY STEEP	115.0	12.8%
Totals for Area of Interest		900.3	100.0%

Marin County, California

120—DIPSEA-BARNABE VERY GRAVELLY LOAMS, 50 TO 75 PERCENT SLOPES

Map Unit Setting

Elevation: 500 to 1,700 feet
Mean annual precipitation: 30 to 50 inches
Mean annual air temperature: 52 to 55 degrees F
Frost-free period: 275 to 365 days

Map Unit Composition

Dipsea and similar soils: 50 percent
Barnabe and similar soils: 20 percent
Minor components: 30 percent

Description of Dipsea

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Residuum weathered from sandstone and shale

Properties and qualities

Slope: 50 to 75 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability (nonirrigated): 7e

Typical profile

0 to 8 inches: Very gravelly loam
8 to 25 inches: Very gravelly clay loam
25 to 48 inches: Very gravelly loam
48 to 52 inches: Weathered bedrock

Description of Barnabe

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave

Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and/or chert

Properties and qualities

Slope: 50 to 75 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 1.5 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability (nonirrigated): 7e

Typical profile

0 to 8 inches: Very gravelly loam
8 to 16 inches: Very gravelly loam
16 to 20 inches: Bedrock

Minor Components

Centissima
Percent of map unit: 5 percent

Maymen
Percent of map unit: 5 percent

Maymen variant
Percent of map unit: 5 percent

Tocaloma
Percent of map unit: 5 percent

Unnamed shallow
Percent of map unit: 3 percent

Unnamed deep
Percent of map unit: 3 percent

Unnamed mod. deep
Percent of map unit: 2 percent

Henneke
Percent of map unit: 2 percent

Data Source Information

Soil Survey Area: Marin County, California
Survey Area Data: Version 5, Dec 10, 2007

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

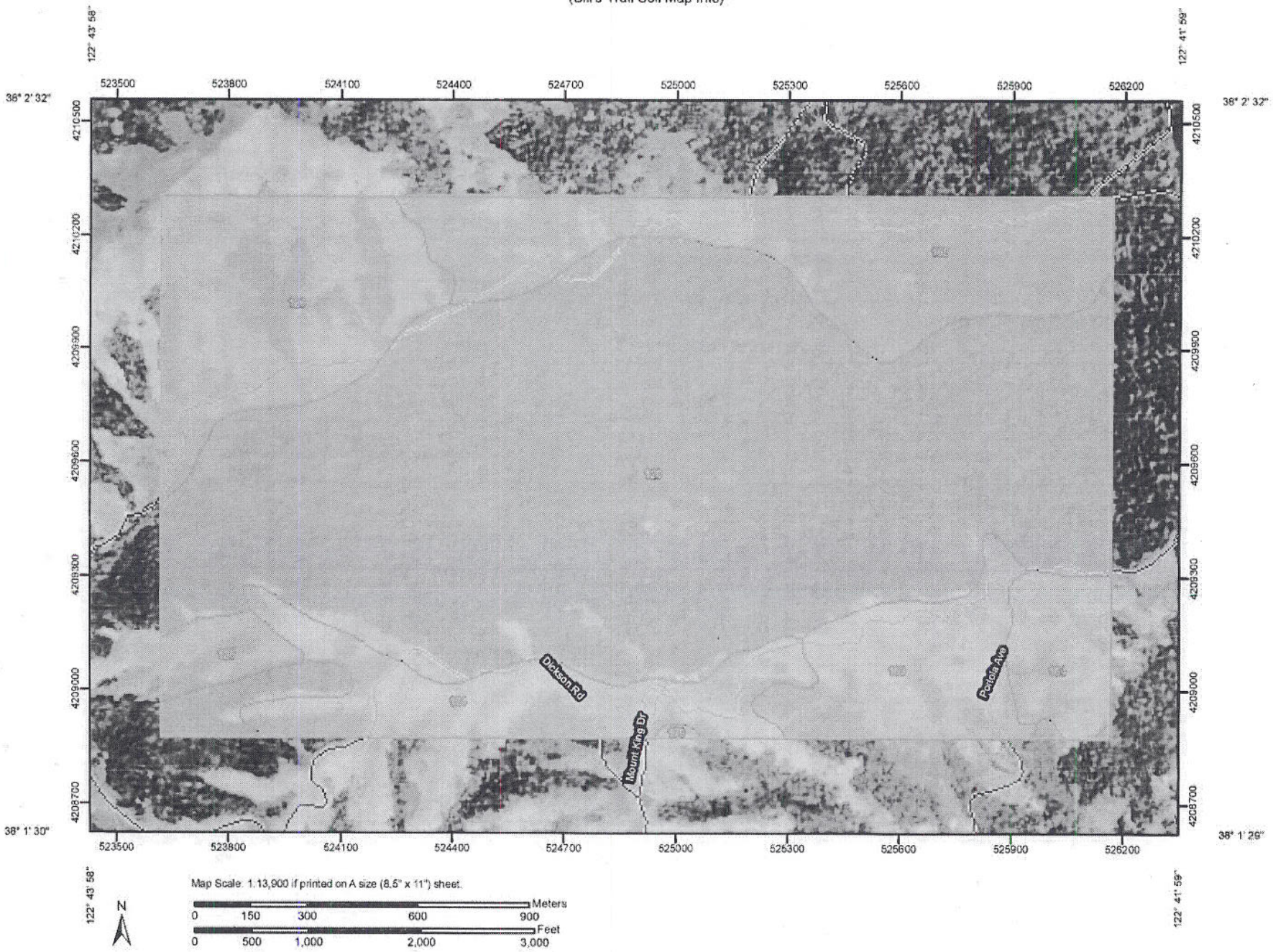
Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
109*:											
McMullin Variant	0-14	Gravelly sandy clay loam.	SC, GC	A-6	0-5	55-80	50-75	45-65	35-50	30-40	10-20
	14	Weathered bedrock	---	---	---	---	---	---	---	---	---
110*, 111*, 112*:											
Centissima	0-15	Loam	ML, CL-ML	A-4	0	95-100	75-90	60-80	50-65	20-30	NP-10
	15-22	Loam, gravelly loam.	CL-ML, SM-SC, GM-GC	A-4	0	70-95	60-90	50-80	40-65	25-30	5-10
	22-33	Very gravelly clay loam, gravelly clay loam, gravelly loam.	GC, SC	A-2	0	45-80	35-70	20-45	20-35	30-40	10-20
	33	Weathered bedrock	---	---	---	---	---	---	---	---	---
Barnabe	0-8	Very gravelly loam.	GM-GC, GM	A-2	0	45-55	35-50	30-45	25-30	25-35	5-10
	8-16	Very gravelly loam.	GM-GC, GM	A-2	0	45-55	35-50	30-45	25-30	25-35	5-10
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
113	0-28	Clay	CH, CL	A-7	0	100	100	95-100	85-95	40-70	20-40
Clear Lake	28-60	Clay, silty clay	CH, CL	A-7	0	100	100	95-100	85-95	40-70	20-40
114	0-10	Gravelly sandy loam.	SM, GM	A-2, A-4	0-10	55-85	50-75	35-60	25-40	20-30	NP-5
Cortina	10-44	Stratified very gravelly loamy sand to very gravelly loam.	GM, GP-GM	A-1, A-2	0-10	30-60	25-55	15-40	5-35	20-30	NP-5
	44-60	Stratified very gravelly sand to very gravelly loamy sand.	GP, SP, SP-SM, GP-GM	A-1	0-10	30-60	25-55	15-45	0-10	---	NP
115*, 116*, 117*, 118*:											
Cronkhite	0-15	Loam	ML	A-4	0	100	95-100	85-95	60-75	25-35	NP-10
	15-26	Clay loam	CL	A-6	0	100	95-100	90-100	70-80	30-40	10-20
	26-45	Clay, clay loam	CL, CH	A-7	0	100	95-100	90-100	70-95	40-55	15-30
	45-55	Weathered bedrock	---	---	---	---	---	---	---	---	---
Barnabe	0-8	Very gravelly loam.	GM-GC, GM	A-2	0	45-55	35-50	30-45	25-30	25-35	5-10
	8-16	Very gravelly loam.	GM-GC, GM	A-2	0	45-55	35-50	30-45	25-30	25-35	5-10
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
119*, 120*:											
Dipsea	0-8	Very gravelly loam.	GM, GM-GC	A-2	0	50-60	30-50	25-50	20-35	25-35	5-10
	8-25	Very gravelly clay loam, very gravelly loam.	GC	A-2	0	50-60	30-50	25-50	25-35	30-40	10-20
	25-48	Very gravelly loam.	GM, GM-GC	A-2	0	50-60	30-50	25-50	25-35	25-35	5-10
	48	Weathered bedrock	---	---	---	---	---	---	---	---	---
Barnabe	0-8	Very gravelly loam.	GM-GC, GM	A-2	0	45-55	35-50	30-45	25-30	25-35	5-10
	8-16	Very gravelly loam.	GM-GC, GM	A-2	0	45-55	35-50	30-45	25-30	25-35	5-10
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

≤ Fine sands

≤ Silts, clays

K Factor, Whole Soil—Marin County, California
(Bill's Trail Soil Map Info)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Soil Ratings
- .02
- .05
- .10
- .15
- .17
- .20
- .24
- .28
- .32
- .37
- .43
- .49
- .55
- .64
- Not rated or not available

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:13,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 10N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Marin County, California
Survey Area Data: Version 5, Dec 10, 2007

Date(s) aerial images were photographed: 6/12/2005

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

K Factor, Whole Soil

K Factor, Whole Soil— Summary by Map Unit — Marin County, California				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
120	DIPSEA-BARNABE VERY GRAVELLY LOAMS, 50 TO 75 PERCENT SLOPES	.10	525.0	58.3%
125	FELTON VARIANT-SOULAJULE COMPLEX, 30 TO 50 PERCENT SLOPES	.37	14.2	1.6%
126	FELTON VARIANT-SOULAJULE COMPLEX, 50 TO 75 PERCENT SLOPES	.37	97.3	10.8%
163	SAURIN-BONNYDOON COMPLEX, 30 TO 50 PERCENT SLOPES	.32	55.1	6.1%
164	SAURIN-BONNYDOON COMPLEX, 50 TO 75 PERCENT SLOPES	.32	92.9	10.3%
179	TOCALOMA-MCMULLIN COMPLEX, 30 TO 50 PERCENT SLOPES	.32	0.8	0.1%
185	TOCALOMA-SAURIN ASSOCIATION, EXTREMELY STEEP	.32	115.0	12.8%
Totals for Area of Interest			900.3	100.0%

Description

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

"Erosion factor Kw (whole soil)" indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Layer Options: Surface Layer

Appendix B

DPR Policy Notice 2005-06 “Trails Policy

State of California - The Resources Agency DEPARTMENT OF PARKS AND RECREATION **POLICY NOTICE** **No. 2005-06**		MANUAL Operations
SUBJECT TRAILS POLICY		CHAPTER 1800, Park Operations (Old DOM 1400 chapter)
ISSUED 8/3/2005	EXPIRES When Incorporated	REFERENCE Supersedes DN 88-65

DPR 375 (Rev. 10/2001)(Word 6/25/2002)

This Departmental Notice has been re-created for transmittal in electronic format. The original notice was signed by Theodore Jackson, Jr., Deputy Director – Park Operations.

The following procedure supersedes those issued in Departmental Notice 88-65. This revision sets the Department's procedure for establishing and approving trails and their appropriate uses and clarifies the management roles and responsibilities of the various levels of the Department.

Preface

California State Parks' mission statement and the California Park and Recreation Commission *Statement of Policy (2.Opportunities)* direct the Department to provide opportunities for high-quality outdoor recreation. Trails are a primary state park facility that offer health-enhancing recreational opportunities, access to park resources for interpretation and education, and enhance community involvement.

Policy

It is the policy of California State Parks to provide trails for accessing park features and facilities and to provide planning that will effectively meet near-term and long-term recreation opportunities. The Department, through a public planning process, will strive to meet the recreational, educational and interpretation needs of its diverse trail users by developing trails within state park units, consistent with unit classification, general plan directives, cultural and natural resource protection, public safety, accessibility, user compatibility and other legal and policy mandates. Multi-use trails and trail connectivity with adjacent public trail systems will be considered in the development of trail plans or individual trails. Further, District Superintendents have the responsibility for implementing emergency, temporary trail closures, through a posted Superintendent's Order, for such reasons as resource protection and public safety. All trail plans, trail development and trail related management decisions will be consistent with the California Environmental Quality Act (CEQA).

Guidelines

The Department's *Trails Handbook* serves as the Department's guideline for trail design, construction, survey, operations and maintenance standards. Trail planning is necessary to effectively balance public access and recreational needs or desires with management requirements to ensure appropriate levels of resource protection and public safety. The *Handbook* provides a detailed Unit Trails Plan template and guidelines that will ensure adequate trail system planning and public input.

Delineation of Responsibilities

Staff responsibilities in implementation of this policy include:

- **District/Sector/Park Units**
  Identify a District Trails Coordinator and provide appropriate trails related training and program development opportunities.

  Complete a comprehensive Unit Trail System Plan for each park unit when feasible and appropriate.

  District Superintendents will be responsible for addressing trails issues that are brought to their attention by staff or by the public within the District in a timely manner.

- **Field Division Chiefs**
  Provide statewide consistency reviews for Unit Trail System Plans and for specific District trail project decisions, such as changes in use, where potential statewide implications may exist. Work with the Statewide Trails Manager in his/her ombudsman role in resolving trail related issues with the public.

- **Deputy Director, Park Operations**
  Responsible for the final resolution of trail related issues brought forward by the Field Division Chiefs and the Statewide Trails Manager in his/her ombudsman role.

- **Accessibility Office**
  Provide review of all trail projects to ensure adherence to Accessibility guidelines, goals and objectives.

- **Statewide Trails Office**
  Provide assistance for the planning and development of Unit Trail System Plans and review plans prior to final approval.

  Assist in planning and coordinating of the Department efforts in trails training and in trail design and construction projects as requested.

  Provide support for grant application preparation for trails-related grant funding sources and acts as the RTP and EEM grants project officer for approved state park projects.

  Assist the Districts in resolving user conflicts and conflicts between the needs of natural and cultural resource protection, public safety and the recreation needs of the public.

The Statewide Trails Manager will serve as a "third party" ombudsman, working with Field Operations and Headquarters' management in addressing California State Parks' public trail issues not resolved at the District level.

- **Department Training Center**
  Provide an ongoing Trails Training Program emphasizing the latest techniques, tools and materials for the design, construction and maintenance of trails.

Conflict Resolution Procedure:

The following standard operating procedure will apply to minimize and resolve public concerns and conflicts regarding trail use in a District. These conflicts may arise from an action such as a new or revised trail plan, park unit general plan or other District policy that affects trail use.

The procedure will create an opportunity for meaningful public input. This procedure could include one or more of the following: creation of an ad-hoc committee that will sunset when the issue is resolved, facilitating public meeting(s), sponsoring user forums, replying to letters, or any other activity that allows the public an opportunity for providing suggestions and/or relaying concerns.

1. Each District Superintendent shall establish a procedure under the guidelines above that best responds to accepting public input/comment on the issue.
2. If an agreement can not be reached, the issue(s) will be brought to the Statewide Trails Office (STO) as a mediating/ombudsman role. The STO will obtain input from all parties affected and attempt to reach a resolution. If agreement cannot be reached, the STO will provide an assessment and recommendations to the Deputy Director of Park Operations.
3. The Deputy Director of Parks Operations will review the information and make a final recommendation to the Director and Chief Deputy Director of State Parks through a Directors Action Request form. The recommendation will include the background on the previous negotiations.
4. Depending on the magnitude of the issue, The Director also has the discretion to determine the method of public input at each step in the process.

Theodore Jackson, Jr.
Deputy Director
Park Operations

Appendix C

Trail Change-In-Use Survey and Trail Log

Trail Use Change Survey

Park (Including Classification): Samuel P.Taylor State Park

Trail Name: Bill's Trail

Location in Unit: Devils Gulch

Current Use Designation(s): Hiking

Proposed Use Type Change: Equestrian and Bike

Use Change Initiated By: District

Evaluation Date: January 18, 2008

Evaluation Criteria	Yes	No
Based on Criteria, Is this Use Change Compatible?	X	
Based on Criteria, Does this Use Change Enhance Circulation?	X	
Based on Criteria, Will this Use Change Decrease Trail Safety?		X
Based on Criteria, is the Trail Sustainable Under Existing Use Conditions?	X	
With the Proposed Use Change Will the Trail be Sustainable	X	
Based on Criteria, Would the Proposed Used Change Create Impacts to the Natural or Cultural Resources?		X
Will the Proposed Use Change and/or Modifications to the Existing Trail Create Additional Facility Maintenance or Operational Work Load?	X	

Recommendation Based on Evaluation Criteria		
Recommend that the Park's General Plan or Road and Trail Management Plan be Developed or Amended to Evaluate this Change in Use		X
Recommend that the Major Reroute be Considered to Accommodate Proposed Change in Use		X
Recommend that the Proposed Change in Trail Use be Approved	x	
Recommend that the Proposed Change Use be Put on Hold - See Comment Box Below		

Summary Criteria Evaluation is Based on the Synthesis of Data from the Following Pages

Comments:

The trail needs re-design modifications, addition of durable pinch points, District needs to enter into MOU's with local mountain bike and equestrians for ongoing maintenance.

Trail Use Change Survey

Evaluation Team Members: Dave Gould | Karl Knapp | Roy McNamee

Qualified Department District Staff will use this survey and checklist to:
(1) Determine the sustainability, trail user safety and feasibility of a proposed change in allowed uses for a single existing trail. Multiple trail use changes in one unit should trigger development or amendment of a unit wide road and trail transportation management plan. The addition of new trails will be considered during the development of a unit road and trail management plan.
(2) Determine the appropriateness of proposed use change in relation to cumulative impacts to the existing uses (users, routing, hiking opportunities, etc)
(3) Support the CEQA document.
(4) Validate the existing conditions described on the attached trail log. The trail log should address typical log elements and positive and negative attributes related to the evaluation criteria.

	Evaluation Criteria	Yes	No	Comments
	#1 Existing Conditions			Describe positive and negative impacts of the proposed change and any other details related to the question to assist decision is made . Put N/A in "No" section for criteria not applicable to trail evaluated.
	Check any existing conditions?			
1.1	Does the Park Unit have a General Plan?		X	
1.2	If Yes, does it address specific trail uses or other management directive supporting the proposed use change			
1.3	Is the "Trail" Proposed a Controlled Access Road		X	
	Road Surface Type:	**Check Applicable**		
1.4	Asphalt			
1.5	Concrete			
1.6	Gravel			
1.7	Native Material			
	Road Facility Use Type			
1.8	Public			
1.9	Administration			
1.10	Fire Break			

Trail Use Change Survey

	Evaluation Criteria	Yes	No	Comments
1.11	Motorized Recreation			
1.12	Non-Motorized Recreation			
1.13	Accessible Route of Travel			
1.14	Road Used as Trail Route			
	Trail Facility Use Type			
1.15	Trail Class I, II, III, IV	I		Enter Trail Classification Here - Not Yes or No
	Current Trail Uses Allowed (on road or trail)	**Yes**	**No**	
1.16	Pedestrian	X		
1.17	Accessible Route of Travel		X	
1.18	Mountain Bike		X	
1.19	Equestrian		X	
	#2 Compatibility for Multi-User Trails			
	Check any existing conditions?			
2.1	Would the proposed use change create incompatible conflict with existing facilities (trail heads, stables, campgrounds etc)?		X	
2.2	Is the proposed use change located on a trail already in a high use area operating at capacity?		X	
2.3	Is there significant user conflict or evidence of unauthorized use	X		
2.4	Is the proposed use change consistent with park classification?	X		equestrians and bikes historically have been used in this park to access the scenic, natural and cultural features of Samuel P Taylor.
2.5	Does the Proposed Use Currently Exist in the Park?	X		
2.6	Based on Above Criteria, Is this Use Change Compatible?	X		
	#3 Affects to Trail Unit User Circulation Patterns			
	Check any existing conditions?			
3.1	Does the Park have an approved road and trail management plan?		X	
3.2	Does the proposed use change provide a loop or semi loop connection?	X		
3.3	Does the proposed use change provide a legal or legitimate route for existing unauthorized trail uses or user created trail?	X		equestrian currently are co-opting the trail, and there is a proposal for the opening the trail to mountain bikes
3.4	Does the proposed use change provide a connection to adjacent land agency which allows similar use?		X	no more than presently exist.

Trail Use Change Survey

	Evaluation Criteria	Yes	No	Comments
3.5	Does the proposed use change improve circulation or relieve congestion on other high use or at capacity trails?		X	
3.6	Does the proposed use change create potential additional use changes on surrounding/adjacent or connecting trails?		X	
3.7	Does the proposed use change deny access or disrupt circulation patterns of existing authorized use?		X	
3.8	Does the proposed use change require a seasonal closure to mitigate resource impacts?		X	closures may occur if determined necessary for facility or resource management.
3.9	If yes, will seasonal closures disrupt circulation patterns?	X		however, alternative routes are available.
3.10	Based on Above Criteria, Does this Use Change Enhance Circulation	X		facilitates a loop trail in conjunction with the existing fire road, especially for the equestrians
	#4 Affects to Trail Use Safety			
	Check any existing conditions?			
4.1	With standard cyclic trail brushing (as required by the trail Class) is there adequate site distance for safe warning for the proposed use change?	X		
4.2	With standard cyclic slough and berm removal is there adequate tread width for safe passage for the proposed multi-user designation?	X		
4.3	With equestrian multi-use, are tread widths safe for the pedestrian and/or bike user to retreat to the downhill side of trail?	X		
4.4	If tread widths for equestrian use is narrow, are the fill slopes gentle, firm and stable for the pedestrian and/or bike user to retreat to the downhill side of trail?		X	As a general rule the slopes are steep, but the tread widths are adequate
4.5	Does the trail have sinuosity that slows bike users?	X		additional pinch points are needed to slow bikers at turns and corners
4.6	Can sinuosity be designed into existing trail tread alignment to slow bike users?	X		on straight sections of trail, there are opportunities for more sinuosity
4.7	Does the use change require removal of special concern plant species to maintain adequate trail widths and sight distances?		X	
4.8	Would use type change create unattainable enforcement of park rules and regulations?		X	although allowing bicycle use would alleviate an enforcement need, the addition of an odd/even schedule may require active management, thus enforcement activity would likely remain the same
4.9	Would use type change create unattainable emergency response?		X	no different the rest the of the park

Trail Use Change Survey

	Evaluation Criteria	Yes	No	Comments
4.10	Based on Above Criteria, Will this Use Change Decrease Trail Safety?		X	with the incorporation of odd/even use schedule and pinch point controls
	#5 Affects to Trail Sustainability			
	Check any existing conditions?			
5.1	Are trail grades commensurate with soil types, use type, season use and facilitate natural hydrologic drainage patterns such as sheet flow?	X		
5.2	Is the trail drainage being captured and released on hillsides and not at natural topographic drainage features?		X	maintenance will catch any problem areas
5.3	Trail tread firm and stable?	X		
5.4	Are there abrupt changes in trail running grade?		X	
5.5	Is the fill slope stable?	X		there is one slide area needing some retaining walls
5.6	Is the back slope/cut bank stable?	X		
5.7	Does the trail tread remain firm and stable in wet conditions?	X		
	Supporting Data From Trail Log			
5.8	Number of Water Bars required for proper drainage			
5.9	Lineal Footage of Berms			
5.10	Lineal Footage of Ditches			
5.11	Lineal Footage Rills and Ruts			
5.12	Lineal Footage log Entrenched Trail			
	Describe the locations and different types of soil types			
5.13	Rocky			
5.14	Rocky/Partial Soil Profile			
5.15	Full Soil Profile			
5.16	Partial Soil Profile/Sandy			
5.17	Sandy			
5.18	Based of Above Criteria, is the Trail Sustainable Under Existing Use Conditions?	X		
5.19	With the Proposed Use Change Will the Trail be Sustainable?	X		

Trail Use Change Survey

	Evaluation Criteria	Yes	No	Comments
	If Not Sustainable, Can Any of the Following Measures be Implemented to Make the Trail Sustainable for the Proposed Use Change?			
	Minor reconstruction of trail tread would:			
5.20	Correct lack of outslope			
5.21	Eliminate abrupt grade changes			
5.22	Stabilize unstable cut bank			
5.23	Stabilize unstable fill slope			
5.24	Correct rilling, rutting,			
5.25	Minor realignment of trail within immediate existing trail proximity would:			
5.26	Stabilize unstable cut bank			
5.27	Stabilize unstable fill slope			
5.28	Eliminate abrupt grade changes			
5.29	Correct unsustainable grades			
5.30	Correct Lack of sinuosity			
5.31	Based on Above Criteria, Can the be Trail Made Sustainable for Proposed Use Conditions?	n/a		
5.32	Should a Major Reroute be Considered to Establish Sustainability		X	
	#6 Affects or Impacts to the Natural or Cultural Resources			
	Would proposed use change and/or needed modifications:			
6.1	impact erosion of existing Trail Tread?		X	
6.2	impact geologic conditions?		X	
6.3	impact sensitive wildlife habitat?		X	
6.4	impact sensitive vegetation habitat?		X	
6.5	impact a riparian or stream environment zone		X	
6.6	impact a sensitive historic feature?		X	
6.7	Would proposed use change and/or needed modifications trigger outside agency permits?		X	
6.8	Is the Trail a historic feature?		X	

Trail Use Change Survey

	Evaluation Criteria	Yes	No	Comments
6.9	Based of Above Criteria, Would the Proposed Used Change Create Impacts to the Natural or Cultural Resources?		X	
	#7 Affects or Impacts to the Facility Maintenance and Operational Costs			
	Would proposed use change and/or needed modifications:			
7.1	change the current classification of the trail?			
7.2	create the need for fill slope or cut bank retaining walls?		X	
7.3	require aggregate or other trail hardening techniques required to maintain tread stability?		X	
7.4	require additional or upgrading of turnpikes or causeways?		X	
7.5	require additional bridges or puncheons?	X		requires modifications to all the bridges existing on Bills Trail
7.6	require additional maintenance to maintain current existing conditions?	X		
7.7	require additional enforcement to maintain user compliance?		X	
7.8	Could the proposed modifications be completed by non-department work forces?	X		
7.9	Could the proposed modifications be maintained by non-department work forces?	X		
7.10	Are durable pinch point native materials readily available?	X		materials are on site, some materials may need to be imported
7.11	Will the Proposed Use Change and/or Modifications to the Existing Trail Create Additional Facility Maintenance or Operational Work Load?	X		additional upfront costs for durable pinch point installation. Offers on the table from users to support pinch point installation

Trail: **Bills Trail** Date: 11/1/2007

Segment _____ Park Unit: Samual P Taylor State Park

Feet	Action	Feature	Size/Qty L	H	W	Units	Comment	Total
0		Rail Fence	35					35
0		Sign					Interp.	0
0	Start and End of Trail Bills Trail							0
46		Junction					Barnabe Peak Trail	0
46		Bridge	41					41
46		Rail Fence	12					12
444	Const	Pinch Point						0
526	NA	DX						0
526	Recon	WB					replace 4" with 8"	0
526		RTW-W	20	2	0.7			26
590	Const	Pinch Point						0
590	Haul	Material	580			lf		580
766		Bridge	20					20
766	Reconst	Bridge					Reconst Rail if M.U. Change	0
823	Const	Pinch Point						0
1294		Rocky Soil	1294					1,294
1412	Reconst	DD						0
1420		Material					3 or 4 pp	0
1460	Const	Pinch Point						0
1677	Const	Pinch Point						0
1719		Full Soil	425					425
1847	Const	Pinch Point						0
1862		RTW-W	16	2	0.7			21
1953	Const	Pinch Point						0
2044		Rocky Soil	325					325
2076		Material						0
2216	Const	Pinch Point						0
2269		Full Soil	225					225
2270		Material					Euc Grove, many pp	0
2432	Const	Pinch Point						0
2500	Const	Pinch Point						0
2545	Const	Pinch Point						0
2694	Const	DD					In Drainage	0
2862		Bridge	20					20
2862		Bridge					Reconst Bridge Railing if Use Changes	0
2934		Rocky Soil	665					665
2974	Const	Pinch Point						0
3230	Const	Pinch Point						0
3322	Const	Pinch Point						0
3404		Junction					Falls Trail	0
3404		Sign					Directional	0

Feet	Action	Feature	Size/Qty			Units	Comment	Total
			L	H	W			
3414		WB-W						0
3424		RTW-W	25	3	0.7			50
3484		Slide						0
3518	Const	Pinch Point						0
3540		Material					down slope	0
3663	Const	Pinch Point						0
3669		Full Soil	735					735
3700		Slide						0
3814	Const	Pinch Point						0
3814		Material					snag upslope 20'	0
3874	Const	Pinch Point						0
3919	Const	Pinch Point						0
3966		Material					snag, 2 pp	0
4235	Recon	SB						0
4279	Const	Pinch Point						0
4366		Material						0
4474	Const	Pinch Point					on ridge nose	0
4594		Rocky Soil	925					925
4660		Material						0
4780	Const	Pinch Point						0
4780		Material						0
4850	Const	Pinch Point						0
4910	Reconst	SW						0
4977	Const	Pinch Point						0
5050		Material						0
5102		Material						0
5270	Const	Pinch Point						0
5375		Material						0
5429	Const	Pinch Point						0
5494		Full Soil Pro	900					900
5530	Const	Pinch Point						0
5564		Rocky Soil Pro	70					70
5635		Material					upslope	0
5649	Const	DD					In Crossing	0
5674		Full Soil pro	110					110
5700	Const	Pinch Point						0
5792	Const	Pinch Point						0
5960	Reconst	SB						0
5989	remove	Limb						0
5989		Material					OH limb	0
6026		Material						0
6115		Material						0
6149	Const	Pinch Point						0
6189	remove	Rootwad						0
6254		Rocky Soil	580				Begin	580
6288	Const	DD						0
6354	Const	Pinch Point						0

Feet	Action	Feature	Size/Qty			Units	Comment	Total
			L	H	W			
6435		Material					upslope	0
6508	Const	Pinch Point						0
6571	Const	Pinch Point						0
6650	Const	Pinch Point						0
6721	Const	Pinch Point						0
6771		Material					down slope	0
6850	Const	Pinch Point						0
6904	Const	Pinch Point						0
7127	Const	Pinch Point						0
7127		Material					down slope, punky	0
7312		WB-W					Failed	0
7362	Reconst	SW						0
7405		WB-W						0
7405		RTW-W	40	2	0.7			53
7454		RF					Ends	0
7454		Full Soil Pro	1200					1,200
7513	Const	Pinch Point						0
7590	Reconst	Rail Fence						0
7620	Const	Pinch Point						0
7620		Material					need to drop material for use	0
7744		Rocky Soil	290				Begin	290
7790	Const	Pinch Point						0
7870	Const	Pinch Point						0
7906	Const	Pinch Point						0
7961		Material					down slope	0
8032		Material						0
8137	Const	Pinch Point						0
8223		Material						0
8387		Material						0
8431	Const	Pinch Point						0
8477	Const	Pinch Point						0
8477		Material					1 pp	0
8750	Const	Pinch Point						0
8750		Material					upslope	0
8809	Const	Pinch Point						0
8942		WB-W					Fail	0
8972	Reconst	SW						0
8979		RF					End	0
9034		RTW-W	40	3	0.7			79
9055		RF					Begin	0
9072	remove	Limb						0
9072		Material					2 pp	0
9115	Const	Pinch Point						0
9164		Material					upslope 2 pp	0
9365	Const	Pinch Point						0
9402	Const	Pinch Point						0
9602		Material					5 pp	0

Feet	Action	Feature	Size/Qty			Units	Comment	Total
			L	H	W			
9759	Reconst	SW						0
9769		Rail Fence					End	0
9839	Reconst	Rail Fence					Begin	0
10036	Const	Pinch Point						0
10057	remove	Trees						0
10057		Material					3 pp	0
10070	Const	Pinch Point						0
10098	remove	Limb					not pp	0
10132	Const	Pinch Point						0
10282	Const	Pinch Point						0
10427		Material					3 pp	0
10547	Const	DD					In Drainage	0
10619	Reconst	SB						
10672		Material					2 pp	0
10692	Const	DD					In Drainage	
10900	Const	Pinch Point						0
10900		Material					upslope 1 pp	0
11100		Material					down slope 2 pp	0
11106	Const	Pinch Point						0
11192	remove	Limb					not pp	0
11244		Material					up and down slope, 6 pp	0
11295	Const	Pinch Point						0
11360	Const	Pinch Point						0
11360		Material					3 pp	0
11419	Const	Pinch Point						0
11584	Const	Pinch Point						0
11712		Material					upslope snag	0
11760	Const	Pinch Point						0
11871		Material					down slope 5 pp	0
12006	Const	Pinch Point						0
12155		Drainage Crossing						0
12155		Retaining Wall	25	2			Monitor	50
12155	Reconst	DD and Crossing						0
12305		Bridge	20				Monitor R Abutment	20
12305		Bridge					Reconst. Hand Rail Lower	0
12323	Const	Pinch Point						0
12425		Material					possible OH limb for matl	0
12500	Const	Pinch Point						0
12545	Const	Pinch Point						0
12587	NA	SB						0
12600		Water Bar					Failed	0
12622	Reconst.	SB						0
12622		Retaining Wall	25	2	0.7			33
12695	Const	Pinch Point						0
12723		Full Soil Pro.	4979				Begin	4,979
12866	Const	Pinch Point						0
12926		Material					up and down slope, 10 pp	0

Feet	Action	Feature	Size/Qty			Units	Comment	Total
			L	H	W			
13032		Bridge	20					20
13032	Bridge						Reconstruct Hand Railing	0
13083	remove	Limb						0
13083	Const	Pinch Point						0
13294		Rocky Soil	571				Begins	571
13300	Const	DD						0
13300		Material					poor choice	0
13419	Const	Pinch Point					make root bump	0
13457	Const	Pinch Point						0
13774		Material					up and down 5 pp	0
13774	remove	log					up slope for sight	0
13807	Const	Pinch Point						0
13906		Material					1 pp	0
14064	Const	Pinch Point						0
14081	remove	Limb					not pp	0
14322	Constr.	DD					In Drainage Crossing	0
14322	Reconst	Bridge					Reconst Hand Railing for M. Users	0
14368	Const	Pinch Point						0
14474	Const	Pinch Point						0
14647	Const	Pinch Point						0
14801		Bridge						0
14801	Recon	Bridge						0
14808		DT					Remove for Open Equestrians	0
14926	Const	Pinch Point						0
15064	Reconst	DD					At Creek Crossing	0
15072	Remove	Berm		0.8	1.5		End	0
15128		Material					snag 3 pp	0
15130	Const	Pinch Point						0
15184	Remove	Berm		0.8	1.5		Begin	0
15281		Material					upslope 2 pp	0
15300		Material					upslope 2 pp	0
15404	Reconst.	DD					At Creek Crossing	0
15477	Remove	Berm					Ends	0
15525	Remove	Berm		0.7	1.5		Begin	0
15607	Reconst.	Switch Back						0
15632	Const	Pinch Point						0
15714	Reconst.	Rail Fence					Ends	0
15773	Reconst.	Rail Fence					Begin	0
15779	Recon	WB					replace 4" with 8"	0
15832		Drainage X-ing						0
15832		RT W	25	2	0.7		Monitor-Sitting in Drainage	33
15883	Reconst	Rail Fence					Ends	0
15964	Const	Pinch Point						0
15975	Reconst.	Rail Fence					Begin	0
15975		Full Soil Pro.	2681					2,681
16000	Const	Pinch Point						0
16012	Remove	Berm					End	0

Feet	Action	Feature	Size/Qty			Units	Comment	Total
			L	H	W			
16063	Const	Pinch Point						0
16069	Remove	Berm		0.7	1.5		Begins	0
16233		DX						0
16250		Material					upslope 2 pp	0
16283	Monitor	RTW	30	5	0.7		Monitor This	99
16283		Rock Soil	308				Begins	308
16384	Const	Pinch Point						0
16447	Const	Pinch Point						0
16544		Material					2 pp	0
16577	Const.	DD						0
16601	Const	Pinch Point						0
16637	Remove	Berm		1	3		End	0
16662	Const	Pinch Point						0
16767		Material					upslope 2 pp	0
16824	Remove	Berm		1	3		Begin	0
16887	Const	Pinch Point						0
17000		Full Soil	717				Begins	717
17052	Reconst	DD					Drainage is Eroding	0
17052		Rocky Soil	52				Begins	52
17277	Const.	DD						0
17344	Const	Pinch Point						0
17407	Const	Pinch Point						0
17480	Const	Pinch Point						0
17590	Remove	Fence					End	0
17682	Recon	Fence					End	0
17682	Remove	Fence					Begin	0
17760	remove	OH						0
17814	Recon	Fence					Begin	0
17825	Const	Pinch Point						0
17920	Const	Pinch Point						0
17935	remove	Limb						0
17935	remove	Limb					2 pp	0
18074	Const.	DD						0
18131	Const	Pinch Point						0
18241	NA	DX						0
18242		Full Soil	1190				Begin	1,190
18303	Const.	DD						0
18455	Const	Pinch Point						0
18455	remove	Limb						0
18605	Const	Pinch Point						0
18645	Recon	SB						0
18680	Const	Pinch Point						0
18718		Rail Fence					Ends	0
18718		Rt-W	10	2	0.7			13
18780	Const	Pinch Point						0
18780	remove	Limb					not pp	0
18944		Rock Soil	702				Begins	702

Feet	Action	Feature	Size/Qty			Units	Comment	Total
			L	H	W			
18955	Reconst	Rail Fence					Begins	0
18982		Full Soil	38				Begins	38
19090	NA	Bridge #7	20				Reconstruct Railings to 30" Ht.	20
19090		Bridge	20					20
19141		Rocky Soil	159				Begins	159
19142		Material					downslope 1 pp	0
19232	Remove	Rail					Remove Rail Ends	0
19310	Const	Pinch Point						0
19362	Remove	Rail					Remove Rail Begin-(Cedar Fence)	0
19365	Const	Pinch Point						0
19600	Const	Pinch Point						0
19674		Full Soil	533					533
19675		Trail Junction					Barnabe FR & Bill's Trail	0
19675		Trail Sign					Directional & Regulatory	0
19675	Recon	Trail					To Provide O/S Drainage	0
19675		Rocky Soil	70				Begins	70
19683	Remove	User Created Trail	45		2		Cutting to Road	0

Appendix D

Trail Use Conflict Study





DRAFT

Trail Use Conflict Study

California State Parks

Road and Trail Change-in-Use Evaluation Process

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Preface

The Trail Use Conflict Study has been conducted to provide information relevant to issues raised by trail user groups regarding their concern that potential for conflicts between trail users may occur as a result of adding uses to California State Parks (CSP) trails under the proposed Road and Trail Change-in-Use Evaluation Process.

While trail use conflict is an important issue for the management of CSP trails, as a social topic it is not included in the definition of environmental impacts under the California Environmental Quality Act. Nonetheless, because of the importance of the issue, as demonstrated by public input to CSP regarding trail management and scoping comments on the Road and Trail Change-in-Use Evaluation Process Environmental Impact Report (EIR), CSP commissioned the Trail Use Conflict Study to provide an up to date understanding of how trail use conflict is addressed by other agencies with responsibility over recreational trail development and management.

The study is provided as an appendix to the Road and Trail Change-in-Use Evaluation Process Program EIR in recognition of the topic's importance to trail management.

Chapter 1. Introduction and Summary

1.1 Introduction

California's recreational trails provide experiences that attract more users than any other recreational facilities in the state. The ability to exercise and enjoy nature in the outdoors is critical to the physical and mental health of California's population. California State Parks (CSP) considers trails to be primary state park facilities that offer health-enhancing recreational opportunities and access to park resources for interpretation and education and has developed a policy and coordinated set of planning guides to manage state park trails. CSP adopted the policy to provide trails for accessing park features and facilities and to strive to meet the recreational, educational, and interpretation needs of its diverse trail users. The CSP Trails Handbook serves as CSP's primary guideline for trail design, construction, operations, and maintenance (CSP 1994). The *California Recreational Trails Plan* provides a guide to management of an integrated system of trail routes to serve California (CSP 2002).

One of the goals of the *California Recreational Trails Plan* is to promote multi-use trail cooperation, recognizing that efforts to integrate or combine different uses on trails have not all been successful. The goal is to "provide the maximum opportunities for the public use of trails by encouraging the appropriate expansion of multi-use trails." CSP is proposing to implement statewide its Road and Trail Change-in-Use Evaluation Process (Process) to assist District personnel in evaluating which existing trails are appropriate for adding or removing trail uses. In reviewing and refining the Process for statewide application, CSP has been considering the influences of trail use conflicts that can occur when multiple types of trail users are present on a facility. This consideration includes a study of the current state of information and understanding of trail use conflicts and approaches for trails managers to address them.

This Trail Use Conflict Study (Study) reflects review of literature and practice nation-wide for addressing user conflict on natural surface multi-use trails. It is an important contribution to the subject of multi-use trail design and management. This Study is specifically focused on CSP trails. CSP has taken a leadership role in addressing the complex physical and social issues that pertain to accommodating multiple users, such as hikers, equestrians, and mountain bike riders, on the same trails. This leadership is consistent with the overall CSP mission and policy to "encourage hiking, horseback riding, and bicycling as important contributions to the health and welfare of the state's population" (Public Resources Code Section 5070-5077.8), as well as the Trails Policy (Policy Notice 2005-06) and the *California Recreational Trail Plan*, to provide appropriate access to nature-oriented, trail opportunities for all Californians.

This Study provides background information for a Program Environmental Impact Report (Program EIR) for CSP's proposed application of the Road and Trail Change-in-Use Evaluation Process (Process) throughout the State Park System. CSP developed the Process to provide criteria for use in consistently and thoroughly evaluating and responding to proposals for change in designated use on existing road and trail alignments.

Two of the objectives of the Program EIR are to conduct a comprehensive environmental analysis of the Change-in-Use Process and, where applicable, to improve upon the existing Process by providing CSP field staff with additional evaluation tools to assess requests to add or remove uses on existing trails and roads in the State Park System. This research helps refine the set of best management practices used by CSP for implementation of change-in-use actions to support the Program EIR's second objective.

1.1.1 Study Goals

This Trail Use Conflict Study has two primary goals:

1) To inform readers of the Program EIR regarding trail use conflict and the nature and extent of the problems as revealed through review and analysis of documents and articles on the subject. The Study provides a summary of the nature of trail use conflict and potential solutions as identified through review of the relevant literature and a survey of trail system managers. The Study draws conclusions regarding the results of the research and their relevance to the CSP trail system and the existing Process.

2) To improve the ability of the existing Process to guide decision-making related to trail use conflict through recommended refinements and enhancements to the existing evaluation tool, trail design guidelines, and best management practices. The existing CSP trail design guideline and management measures that help avoid or reduce trail use conflict are reviewed as part of the Study.

This Study provides two sets of recommendations related to the consideration of proposed road and trail changes-in-use. The first recommendations presented are contained in a Checklist for Low-Conflict Multi-Use Trail Design. This clarifies how trails can be designed to comfortably and safely accommodate a mix of hikers, equestrians, and mountain bicyclists, and comply with rules and guidelines for safe, considerate, and low-impact use.

Management of trail use conflicts depends on compliance with the appropriate type of trail use, and rules and guidelines for trail use and behavior, including reasonable speed consistent with trail design and use objectives, yielding to other users per the "yield triangle" (which informs trail users when to yield to other types of users), warning when passing, and having the appropriate knowledge or skill to be on trails shared with other users. The second set of Recommendations is contained in a Checklist for Multi-Use Trail Conflict Management. This contains measures for getting the information to the trail users about appropriate trail use; monitoring trail use, encouraging compliance, and where necessary, responding to situations of non-compliance that can result in conflicts.

1.1.2 California State Parks Trail Policy Setting

Although the research and recommendations presented in this Study are relevant to the CSP trail system, many of the agencies interviewed and documents reviewed for this Study involve non-CSP trail systems with a different mission than CSP. Thus, some of the design and management approaches from these sources, while informative, may not be appropriate for CSP trails.

CSP provides trails to allow people to experience and enjoy nature. This is clearly established in the California Public Resources Code (emphasis added):

> 5019.53. **State parks** consist of relatively spacious areas of outstanding scenic or natural character, oftentimes also containing significant historical, archaeological, ecological, geological, or other similar values. The purpose of state parks shall be to preserve outstanding natural, scenic, and cultural

> values, indigenous aquatic and terrestrial fauna and flora, and the most significant examples of ecological regions of California . . .
>
> Each state park shall be managed as a composite whole in order to restore, protect, and maintain its native environmental complexes to the extent compatible with the primary purpose for which the park was established.
>
> Improvements undertaken within state parks shall be for the purpose of making the areas available for public enjoyment and education in a manner consistent with the preservation of natural, scenic, cultural, and ecological values for present and future generations. Improvements may be undertaken to provide for recreational activities including, but not limited to, camping, picnicking, sightseeing, nature study, hiking, and horseback riding, so long as those improvements involve no major modification of lands, forests, or waters. Improvements that do not directly enhance the public's enjoyment of the natural, scenic, cultural, or ecological values of the resource, which are attractions in themselves, or which are otherwise available to the public within a reasonable distance outside the park, shall not be undertaken within state parks.

Although Public Resources Code Section 5019.53 mentions only hiking and horseback riding, policies regarding access to mountain bikes on trails have since been added (State Park and Recreation Commission, Policy IV.2, Non-Motorized Bike Use. 2005), and CSP's mission now includes accommodating mountain bikes on trails . The same principles apply: CSP trails are not designed or intended to serve as active recreation facilities where nature appreciation may be secondary to athletic or skill challenge. Mountain bike speed or technical riding, equestrian endurance or poker runs, and group trail runs are examples of activities that are not compatible with CSP trails, shared or otherwise. CSP trails are generally designed to accommodate a passive, nature-oriented type of shared trail use by combining the design requirements for each individual use into a trail on which they can comfortably mix.

1.1.3 Research Scope

The research for this Study includes a review of existing literature pertaining to trail use conflict issues, as well as a survey of U.S. agencies and organizations that manage significant mileage of multi-use trails and may have information or informed opinions about the nature of the problems and potential solutions. The literature review was limited to documents from the U.S. and Canada, but it includes research examples from other countries where they are cited in U.S. or Canadian documents.

This research effort focused on natural surface trails in natural land settings comparable to units of the California State Park System. It focused on multi-use trails with a combination of hikers, equestrians, and/or mountain bikers, and conflicts between these groups. Although conflicts on paved trails were frequently mentioned in the responses, paved trails are not a focus of this Study because the Road and Trail Change-in-Use Evaluation Process does not address paved trails. Also, although conflicts regarding dog access were mentioned in some responses, they are not addressed, because dogs are typically prohibited on CSP trails. This Study also does not address the relative maintenance or environmental impacts of different trail use types, which are subjects of the Program EIR and a separate erosion vulnerability study.

The research sought to identify when, where and why trail use conflict incidents occur on the trail system; which user groups are most often perceived to be in conflict; and what strategies are used to minimize conflict concerns. The research also sought to determine the most prevalent types of conflicts (users involved, specific

reasons, frequency, etc., as measured in complaints); what factors exacerbate or alleviate feelings of conflict; and strategies that managers have found to be successful in addressing conflict.

The research sought data reflecting rigorous study of use conflict and solutions, however, few studies have empirically measured the nature of trail use conflicts or the effectiveness of solutions. The research results highlight the most thorough, objective, and often-cited government or academic research, and planning, design, or management standards or guidelines that address multi-use trails.

1.1.4 Study Notification and Input

The Study team (CSP staff and consultants) developed the initial list of documents to review and agencies to survey based on internet research, including academic and professional sites, and input from CSP staff. The team strove to make the list as inclusive as possible by seeking suggestions of pertinent information or experience from the public, agencies, and organizations.

At research initiation, the people who signed in at the Notice of Preparation (NOP) scoping meetings or who made subsequent comments on the scope of the Program EIR during the scoping period received a notice of the study and solicitation for additional documents, data, and knowledgeable contacts. The notice was also sent to trail-related organizations and posted on major trail-related web sites, as shown in Table 1-1. The research considered all suggestions received through this process; if the Study team found that a document was not directly pertinent to this Study, this was noted, and the document was not included in the annotated bibliography.

Table 1-1. Study Notice Placement

Group	Method
American Trails website	Posted
Association of Pedestrian and Bicycle and Professionals (APBP)	E-mail to list serve
Individuals who signed into the NOP scoping meetings	E-mailed
International Mountain Bicycling Association (IMBA)	E-mailed to staff
Rails-to-Trails Conservancy (RTC)	Sent in April member e-newsletter
Responsible Organized Mountain Peddlers (ROMP)	E-mailed to staff
Sierra Club	E-mailed to staff

Comments and documents provided through these resources are listed in Appendix D.

1.1.5 Organization of the Document

Chapter 1 of this Study introduces the purpose and research scope for this Study. It clarifies the setting and use characteristics considered in the Study, and summarizes the findings derived from the research.

Chapter 2 presents the recommendations related to appropriate trail design as well as management and outreach strategies to address trail use conflict.

Chapter 3 summarizes the overall research results from the review of relevant literature and survey of trail managers regarding conflict issues, appropriate design solutions, and management solutions for addressing user conflicts.

Chapter 4 provides a bibliography of the literature and agency staff comments cited in Chapters 1 through 3.

A glossary with list of acronyms used in chapters 1 – 3 is provided after the Table of Contents.

These chapters are supported by the following appendices:

- Appendix A provides the recommended design and management measures in summary checklist forms and examples of how the existing CSP documents used for the Change-in-Use Process can be modified to incorporate the measures and related recommendations.
- Appendix B describes the methodology used for the review of the literature and discusses the results by topic. It also includes summaries and critiques of the "key" documents that provided the most pertinent information for this Study.
- Appendix C describes the Agency Survey, including methodology, agencies surveyed, and an analysis of results by topic for the 36 surveys returned. The chapter also provides an overview of the findings from the most pertinent individual surveys received. These were agencies that had environmental settings, trail systems, and/or policies most similar to CSP, and that provided specific data and recommended measures regarding trail use conflict. Appendix D outlines the outreach conducted to user groups for the Program EIR and this Study, as well as the comments and recommendations received.
- Appendix E provides the list of literature considered in the review, as well as a complete annotated bibliography of all literature reviewed that was determined to be relevant to trail user conflicts.
- Appendix F lists all surveys returned.
- Appendix G presents relevant portions of the current CSP *Trail Handbook* and draft unpublished CSP trail design guidelines.

1.2 Summary of Research Findings

Analysis of the data collected shows that the primary management concern on multi-use trails is conflict based on users' perceptions and behaviors, and that actual accidents involving different user types were rare. The overall findings regarding the nature of trail use conflicts, including potential solutions to these issues, are based on a substantial body of data and informed professional and expert opinion.

1.2.1 Types of Conflict Reports or Events

The research found that evidence of trail use conflict was represented in three basic forms: general comments or complaints, conflict incidents, and as a subset of the incidents, accident events. Clarification of these terms is important to understanding the results:

- "General comments or complaints" are general issues raised that do not include documentation of a specific incident event. These general concerns were often represented in opinion surveys of trail agency managers or trail users that were included in the literature reviewed, or were expressed in the survey of trail agency managers conducted as part of this Study.
- "Incidents" are events that were brought to the attention of trail management staff, typically involving a specific concern or complaint. Incidents can include wildlife encounters and a range of other issues,

but when related to trail use conflict, they tend to involve one user feeling that his/her experience was diminished and/or his/her safety was threatened by another user, and/or a violation of the rules occurred. Incidents include both non-accident and accident events.

- An "accident" event is a type of incident where someone is injured, or falls, but avoided injury. An incident report could include details of an accident. This could be a single user event, or multiple users of the same type, or multiple users of different types. .

1.2.2 Reference Citations

In the following summary findings, where a theme was cited by one or more sources, the reference follows. If several sources supported the finding, the text provides general reference to support without specifically identifying all documents or agencies. These findings and the supporting documentation are presented in more detail in Chapter 3 and 4 and Appendices B and C.

1.2.3 Significant Research Findings

Six significant conclusions were derived from the Literature Review and the Agency Survey results. These findings are listed below, with supporting documentation.

1. **Information on trail use conflict is primarily based on opinion; little data about actual user conflicts are available.**

The existing literature and the survey responses primarily consist of the opinion of trail system managers and users; even peer-reviewed academic or U. S. Forest Service (USFS) publications primarily rely on manager and user surveys. There is limited detailed report data about actual trail use conflict incidents, such as complaint or incident reports, rigorous analysis regarding the nature and extent of trail use conflict issues, or the results of strategies addressing them.

While there is a wealth of documents and articles on the topic of user conflicts on multi-use trails, the majority of the literature does not provide empirical data regarding the presence, extent, or attributes of user conflict incidents. Although 63 of the 80 Literature Review sources define the problem of trail user conflicts, several of them do so as a presupposition based on previous literature (14 sources), or the author's experience (13 sources). Several sources present surveys on managers' perceptions of conflict (9 sources) or users' perceptions of conflict (22 sources). None of these surveys asked the frequency of actual incidents. However, this notable lack of citations regarding specific incidents, including accidents, implies that they are infrequent.

The Study team requested incident and complaint data from each agency sent an Agency Survey. This request was reiterated when surveys were returned. The survey also asked respondents to provide their professional judgment about the frequency of complaints, which may include formal written complaints or discussions at events, public meetings, or other feedback. Respondents were also asked about the frequency of accidents with injuries due to collisions, non-injury collisions, and 'close calls' negatively affecting user experience.

The survey responses showed that agencies rarely maintain detailed data on complaints, incidents, or accidents. Where data are collected, incidents (including accidents) involving multiple user types are often combined with single user or same user types of accidents and separate statistics are not available. Though the research results reflect primarily informed opinion rather than empirical data, there is clear evidence that

accidents are rare compared to the number of incidents, and actual incidents tend to be rare in relation to extent of comments and complaints about conflict between trail user types.

2. Complaints and controversy about other trail users are common.

Several manager and user surveys from the Literature Review indicate the importance of trail use conflict as an issue for trail managers. Over half of the 40 recreational managers from the USFS and U. S. Bureau of Land Management surveyed via telephone reported conflicts between mountain bikers and other user groups (Chavez 1993). A survey of state park Directors of all 50 states found that 77 percent reported trail use conflict as an issue (Schuett 1997). A survey of USFS Managers in the 1990's found that over a third (34 percent) of National Forest managers were concerned about mountain bikers' conflicts with other user groups. This topic was second only to concerns about effects on natural resources (42 percent); (Chavez 1996a).

The Agency Survey found that complaints of conflict are relatively common compared to incidents, based on staff estimates of the frequency with which they receive complaints. Agencies typically receive complaints on a monthly or weekly basis (13 of 25 agencies), and more than two-thirds of the 36 agencies that returned surveys felt that they had significant issues with user conflict on natural surface shared-use trails.

In addition, the extent of literature written on the subject and plethora of studies indicates the contentiousness of the subject of sharing uses on trails.

3. Actual incidents, including those involving accidents, between trail users are relatively rare.

Most agencies group information about all incidents and accidents between users together. However, in some cases it is possible to separate incidents that do not result in injury or a physical altercation.

An Environmental Assessment for the National Park Service (NPS) recorded users on a section of the Cactus Forest Trail in Arizona during a six-month trial period, finding only three minor incidents, including two user complaints and a ranger reminding a mountain bicyclist to yield to equestrians (NPS 2003)

Resources from the Literature Review that consider accidents on trails found there to be a very low frequency of accidents, in general, and few of these involve multiple user types. An early study in the East Bay Regional Park District (EBRPD) found 24 cycling accidents reported from July 1987 to June 1988. Among the accidents, two cases involved two mountain bikers colliding and one involved a cyclist falling to avoid a hiker (Morioka, Steven in Sloan, D. and T. Fletcher, Ed. 1989).

Literature that does not provide data on accidents, but which relies on opinion surveys of trail managers, supports the conclusion that accidents are rare, compared to conflict incidents. The USFS Manager survey found that only 13 percent of managers had "safety concerns" (including wildlife encounters and conflicts with automobiles at trail crossings) related to mountain bikers (Chavez 1996a). A survey of Ohio State Parks and Park Districts about mountain bike management found that 30 percent of the respondents had observed or received reports of user conflict related to mountain biking, while 27 percent reported accidents, and 13 percent reported safety problems of all types (Longsdorf 2006).

In the Agency Survey, the few agencies that record incidents seldom differentiate incidents related to multi-use, but combined incidents are relatively rare in the context of overall trail use levels. Eight of the agencies in

the Agency Survey collect incident data, and four of those had not had any recorded incidents. The majority of agency representatives surveyed responded that, in their professional experience, actual incidents are uncommon; 18 of the 28 agencies responding to the question reported that incidents occur annually or less frequently.

4. Trail use conflict is an important social issue.

There is a strong body of study and informed opinion indicating that trail use conflict is an important social issue, and that the orientation, perception, attitude, and behavior of users are major factors in generating concerns and complaints about trail conflict. Though it tends to be social/perceptual, rather than represented by significant physical evidence, trail use conflict is a very real issue for almost all multi-use trail managing organizations.

Conflicts between trail users are shown to be highly influenced by perception, attitudes, and behavior on both sides of conflicting parties. Conflict has been described in the literature as goal interference, which can be either interpersonal (based on physical presence of other users) or social (based on perception of a group; no contact or sighting has to occur) (Jacob and Schreyer 1980; Moore 1994; Carothers, Vaske, and Donnelly 2001; Cessford 2002; Bradsher 2003; Chiu and Kriwoken 2003). Moore (1994) wrote that "conflict has been found to be related to activity style (mode of travel, level of technology, environmental dominance, etc.), focus of trip, expectations, attitudes toward and perceptions of the environment, level of tolerance for others, and different norms held by different users." Watson, a researcher with the USFS, observes that perceptions of conflict are frequently unrelated to measurable incidents of interference in outdoor recreation, but rather reflect an attitude towards wilderness and stereotypes of other user groups (Watson 2001)

USFS Lake Tahoe Basin Management Unit (LTBMU) staff noted that use conflicts are "very subjective and determined by individuals" (LTBMU response to CSP Trail Use Conflict Survey, 2011). Three agencies noted entrenched negative perceptions of other user groups arising from a history of conflict or disagreement; CSP Gold Fields District, the Front Country Trails Multi-Jurisdictional Task Force, and Jefferson County Open Space all cited historic conflicts contributing to an environment where managers had difficulty addressing root causes of conflict perceptions.

Reported conflicts between trail user types tend to reflect perceptions of being unsafe or merely bothered, due to the presence of other types of trail users. Many of the comments received from the Program EIR scoping meetings stated that conflict is related to mountain bikers failing to yield or passing too quickly. Similarly, common concerns related to user conflicts in both the Literature Review and the Agency Survey include mountain bikers' speeds and lack of warning and/or yielding when passing. Of the 36 surveys completed, the most frequently-noted conflicts were between pedestrians/hikers and bicyclists/mountain bikers (68 percent). The second most frequently-noted concern was conflicts between users with dogs and those without (41 percent), but dog access is not within the scope of this Study, because dog walking is generally not allowed on CSP trails. Only 18 percent of issues cited in the Agency Survey were between equestrians and mountain bikers, despite this being a prevalent concern in the Program EIR scoping comments.

Six percent of the survey respondents noted that the users' purpose of visiting the trail influenced their behavior; conflicts between recreationalists and families were mentioned. Less-frequent conflicts cited were caused by meet-up groups and running clubs or other users traveling side-by-side and blocking the trail.

Comments at the Program EIR scoping meetings included concerns that mountain bikers' speeds discourage equestrians and hikers from using the trails.

5. Design of trails to accommodate multiple use helps to avoid or reduce conflict.

There are common themes, but there is also significant variation, in trail design principles in the literature and agency practices to address low-conflict, multi-use trail design, or user-specific trail design. Many agencies and organizations incorporate a few of these principles into published trail design standards or guidelines, but few trails have actually been designed and constructed from the outset using these multi-use design principles. Although informed opinion expressed points about the performance of these designs in addressing trail conflict, no data about actual use and frequency of trail conflict incidents were found.

Several documents from the Literature Review support the use of appropriate trail design as critical to managing multiple use. Similarly, in *Trails for the 21st Century*, Flink, Olka, and Searns (1993) stress the importance of designing a trail with the users in mind, stating that, "accommodating a range of users within a single trail depends on trail width, trail surface, and speed of trail users." A recent study conducted by the East Bay Regional Parks District (EBRPD) found that combining use on trails not designed for multiple use has created management challenges for participating agencies (EBRPD 2011).

In addition, several responses from the Agency Survey note the importance of appropriate design. Eight agencies noted that concerns of incidents more frequently occur at turns and corners or other locations with poor visibility. Inappropriate trail width, slope, and designs that allow users to travel at excessive speed are all circumstances that respondents were concerned would exacerbate user conflicts.

Beyond the conclusion that design is important to address trail use conflict, the Study found that conflict-specific design standards in the literature and agency survey responses varied widely, though there were some principles that were commonly mentioned. The design measures had mixed applicability to the CSP setting. The recommendations in this Study incorporate those that have the most applicability and benefit, along with existing CSP trail design measures.

6. User education and outreach are key methods to avoid or reduce conflict.

There was a strong indication in the literature and in agency comments that active efforts to manage and work with users are necessary to address conflict, although elimination of the perception of conflict can be very difficult to achieve. Several trail user surveys indicated that additional education and outreach can reduce conflicts between users. Users who had experience with other trail activities felt less conflict when encountering participants of those activities than respondents who had never performed those activities before (Bradsher 2003).

1.3 Summary of Recommendations

The Study recommendations to reduce trail use conflict are presented in Chapter 2 and feature two checklists of measures to be used as part of the Process, summarized below:

1) Recommendations for low-conflict, multi-use trail design:

The design recommendations include nine interrelated elements that support low-conflict multiuse natural surface trail design:

- **Tread Width and Passing Space.** Provide sufficient width of the trail tread and existing or created space to allow users to pass each other, either as a continuous condition, or as passing spaces at defined intervals. This also includes vertical clearance from overhanging trees and objects.
- **Sight Distance.** Include adequate length of the trail visible ahead to the user. This is particularly important to resolve in conjunction with speed control features, turns, and sinuous layout.
- **Turn Radius.** Create a minimum inside radius of turns to ensure that they can be comfortably negotiated.
- **Sinuosity.** Lay out a trail with many curves and minimal straight sections (however, with sufficient sight distance). This helps limit the speed of mountain bikers and other users.
- **Speed Control Features**. Install pinch points, choke points, trail anchors, technical trail features, 'stiles', and other elements specifically designed to limit users' speeds.
- **Surface Texture.** Design the relative smoothness, evenness, and firmness of the trail tread to moderate travel speed by mountain bicyclists, including the presence of irregularities.
- **Low Trail Structures.** Avoid steps and waterbar structures that constrain access for horses and mountain bikers and can create points of conflict.
- **Gradient.** Apply design limits or variations in the gradient of the trail to allow for multiple uses.
- **Trail Layout and Classification.** When considering trail suitability for multiple uses, factor the level of use of the trail, availability of alternative trails and routes, and the potential for trails to primarily serve one or multiple user types.

2) Recommendations for multi-use trail conflict management:

Management Strategies:

- **Rules**. Adopt enforceable rules, regarding staying on designated trails, right-of-way, warning when overtaking, speed limits, etc.
- **Enforcement**. Establish enforcement strategies, including monitoring, warnings, radar and citations.
- **User Information**. Provide information to users about rules, polices, and advice for trail user respect, right-of-way requirements, courtesy, routes, destinations, and conditions.
- **Data Tracking**. Collect and track data on trail use conflict incidents and design or management response successes.
- **Separate Trails and Specialized Trails**. Alternate use days, provide one-way trails, and designate use-intensive trails.

User Outreach and Coordination Strategies:

- **Education**. Provide user-specific printed materials and web postings, and/or an active, focused public relations campaigns to educate users about trail use rules and appropriate behavior.
- **User Group Relations**. To establish or improve constructive relationships with user groups, arrange and conduct general meetings with user groups about trail safety or conflict-related issues, or

objectives, such as making improving and maintaining trails and making the trail experience more enjoyable.

- **Volunteer Programs**. Organize, encourage, and /or support establishment of volunteer trail stewardship programs, such as ongoing trail patrol and/or maintenance assistance, specific projects, and help with outreach and education regarding conflict avoidance, safety, and courtesy.
- **Events**. Organize, encourage, and/or support multi-user social, fun, trail construction, or maintenance events (e.g., Trail Clean-up Days).

Checklists that provide more detail about these recommendations are presented in annotated form in Chapter 2 to help explain the background, context and objectives. They are provided in simplified checklist form in Appendix A for ease of use by CSP staff. Chapter 2 describes and Appendix A illustrates how the checklists can be integrated into the existing CSP checklist used to evaluate the feasibility of proposed trail use changes.

Chapter 2. Recommendations for Addressing Trail Use Conflict

This chapter provides recommendations for refining or augmenting the California State Parks (CSP) Road and Trail Change-in-Use Evaluation Process (Process) to help avoid or reduce trail user conflicts on natural-surface, multi-use trails. The recommendations reflect review of existing CSP trail design guidelines and practices and review of guidelines and standards from other agencies and organizations where they were found to be relevant to CSP trail types and policies. These recommendations are intended to become integral parts of the change-in-use evaluation process.

2.1 Summary of Evaluation Process

The Road and Trail Change-in-Use Evaluation Process facilitates consideration of changes in use of existing State Park roads and trails to best accommodate trail access to natural and/or cultural resources for which a park unit was established and that are appropriate for each road or trail facility. The Process seeks to provide CSP with a systematic evaluation tool to consider proposals to modify roads and trails to add or remove particular uses.

The Process includes steps that lead to recommendations regarding change-in-use proposals, as described and shown graphically in the *Proposed CSP Road and Trail Change-In-Use Evaluation Process Flowchart*. (see Figure 2-1). The CSP decisions regarding proposed changes in use may include: approval, denial, conditional approval pending modifications, rerouting to accommodate the changed uses, modifications to planning documents to implement the proposal, deferral of the decision, or management responses instead of physical changes to the trail.

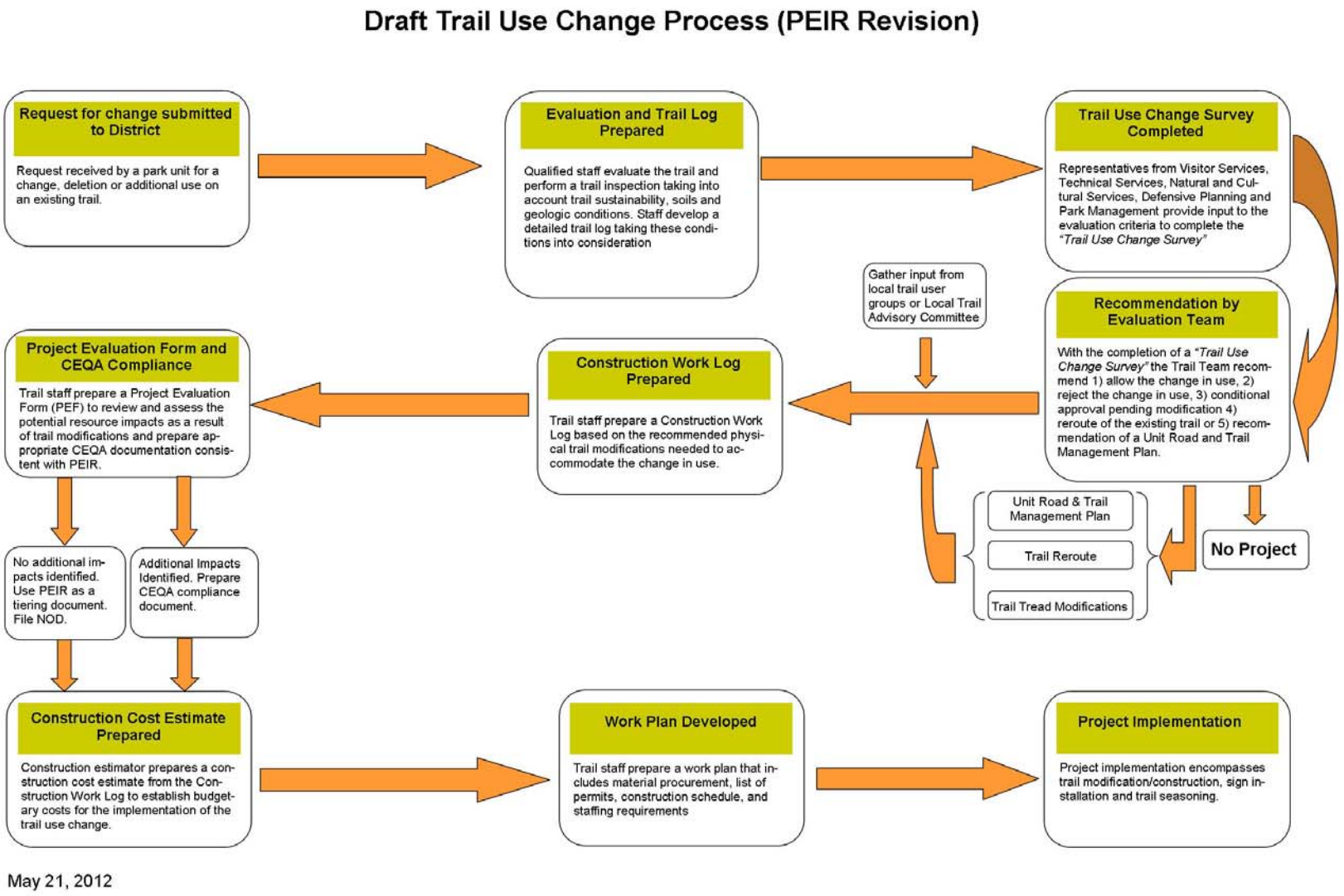


Figure 2-1. Road and Trail Change-in-Use Evaluation Process Diagram

2.2 Incorporating the Recommendations

The recommendations presented in this chapter take the form of two new checklist documents to support the Process:

1) Checklist for Low-Conflict, Multi-Use Trail Design, and
2) Checklist for Multi-Use Trail Conflict Management.

The recommended checklists include specific measures to implement appropriate multi-use trail design for the individual user types and their combination, and specific measures that can be taken to encourage appropriate trail use and behavior, and understanding of other trail users' needs and rights. Research for this Study has shown that, applied together, these measures can minimize trail use conflict.

The recommended checklists are intended to be referenced and incorporated into the Road and Trail Change-in-Use Process by supplementing the existing checklist used to evaluate the feasibility of trail use change. Specific recommended changes to the forms are presented in Appendix A of this Study. A general description of the changes to the forms is provided below:

Evaluation and Trail Log

The Evaluation and Trail Log notes the physical conditions and requirements for the proposed use to be added to (or in some cases removed from) the road or trail. The Checklist for Low-Conflict, Multi-Use Trail Design should be applied at this stage.

The evaluation of existing physical conditions and determination of the implications for improvements to add (or remove) the use under consideration should include review of the checklist, with results reflected in the Trail Log.

In some cases the evaluation may find that conditions and feasible modifications for use-appropriate design do not support an existing use. This could potentially result in that use being removed.

Trail Use Change Survey

The Survey form considers the results of the Evaluation and Trail Log and makes a finding regarding overall feasibility.

The Checklist for Trail Use Conflict Management would be completed in parallel with the Trail Use Change Survey, to inform CSP staff about potential trail management needs and opportunities; not as a direct basis for the decision of feasibility of the proposed use change.

Like the physical conditions or changes pertinent to accommodating specific uses and addressing trail use conflict, the Trail Use Conflict Management Checklist evaluation is not a "make or break" factor in the trail use change decision, but it is an important consideration and part of the ultimate Work Plan.

Work Plan

The Work Plan is the comprehensive implementation plan for the change-in-use project. Completing the Trail Use Conflict Management Checklist will generally identify conditions, accomplishments, and needed actions. As part of the Work Plan an action plan should be developed for management, outreach, and coordination tasks, including follow-up monitoring and reporting of conflict issues and response successes.

Integrating these work elements throughout the Process will help ensure that it is comprehensive and effective.

Monitoring and reporting is already a part of the trail management process. A standardized system of collecting, assessing, and responding to data regarding trail use conflicts, and a centralized database, would help identify "trouble spots" across the state that may deserve special attention in terms of technical support. It could also include requests for local, state or national user group assistance to address the issues identified. If issues can be clearly documented, there is greater potential to provide constructive comments to the parties that may be responsible for inappropriate behavior or lack of understanding of how their use may affect or be perceived by others. Data collection also improves the change-in-use process by measuring the success/failure of specific actions. Designing such a data collection and management system is beyond the scope of the current Study, but it is recommended as an important step in managing multi-use trails.

2.3 Background for Recommendations

Appropriate multi-use trail design and management improves user satisfaction. This can result in users staying on the designated trail alignments and not creating unauthorized or volunteer trails. A higher level of user satisfaction also results in maintaining the use levels of the trail with no significant reduction of trail usage because of user displacement.

The research for this Study entailed review of numerous guidelines, standards, and practices used by local, regional, state, and national agencies and organizations to design and manage multi-use trails. The research sought examples that were related to trail systems in natural settings similar to CSP, with similar allowed uses, and a similar emphasis in trail use policies of providing public access to the resources of a park. The reviewed documents vary widely in terms of consistency with the CSP setting. Even the documents and practices from trail systems that are most comparable typically do not explicitly or thoroughly address ways to minimize conflict through design. Instead they tend to focus on design for low maintenance and environmental impact (together often termed sustainability), and user enjoyment. The goal of the recommended design measures is to identify those design elements that accommodate individual user types (hikers, mountain bikers, and equestrians), as well as combinations of those users in a design that meets each type of user's needs and minimizes the potential for conflicts between them. The most useful new guidance was found in the area of management measures and user outreach, and coordination to reduce trail use conflict. Although CSP documents mention many aspects of these measures, for the most part the recommended management measures are new, while the design measures are built upon existing CSP guidelines.

Natural-surface trail design is difficult to standardize across the country. By comparison, design of the public highway system has been the subject of many decades of intensive study, leading to a shared set of national standards for design and use management. Lack of consistency in multi-use natural-surface trail design standards is due in part to the highly complex and variable settings presented by the wide range of natural and open space landscape types. Also, each managing agency tends to have its own mission, policies, and traditions regarding the appropriate types of use, as well as design.

Through building codes and other standards, common practices have evolved for nearly every type of public facility to ensure they work for the intended use and provide for public safety. Natural-surface, recreational trails are, and logically should be, the "next frontier" in standardization. They are intended to allow people to

experience nature on nature's terms and not to standardize nature for their convenience. However, some level of modification of nature is necessary to provide access, especially for mountain bicyclists and equestrians. Bicycle access to nature and all the benefits of nature-oriented trails is clearly a growing need and desire of the increasingly urbanized U.S. population. Access for horses is an ongoing tradition and continues to be a strong demand. Shared use design standards are needed and are gradually emerging, evolving, and being adapted to local, regional, state and national trail settings.

In some respects, as public, multi-use, recreational transportation systems, multi-use trails can be compared to the national highway system – the most standardized end of the transportation project spectrum. The highway system is carefully designed to maximize safety while accommodating multiple user types, including passenger cars, motorcycles, and freight vehicles. These users may individually resent the presence of the other types of user, but they generally accept their right to use the road, and the rules and design features to avoid conflicts.

The Federal Highway Administration (FHWA) Office of Safety aims to ensure and improve safety on highways using a systematic approach that addresses all "4Es" of safety: engineering, education, enforcement, and emergency medical services. As indicated in this multi-pronged approach, design is a key element of conflict avoidance, but incidents can still occur between users for other reasons. There is no comparison between the size, speed, and volumes of traffic on the street and highway system with multi-use trails, but the principles of design and management for use accommodation and safety are the same.

Good design is a critical component of providing low-conflict, multi-use trails, but it needs to be accompanied by education about proper user behavior and enforcement to encourage users to abide by the rules of the trail to minimize trail use conflicts. On the highway system, accidents can never be completely eliminated. When the number or type of accidents reveals a problem, safety measures are prioritized, including redesign, information campaigns, and increased enforcement. Likewise, trail accidents, including those between different types of users (which are already rare), can never be completely eliminated, but CSP and other trail managers work to minimize the risk of accidents. Appropriate evaluation of whether a trail is a candidate for multi-use should consider trail design, behaviors and perceptions of current and prospective trail users that exacerbate conflict, and possible enforcement requirements. Appropriately addressing these considerations could substantially reduce the actual likelihood of trail conflicts, and greatly reduce the perceived concern about them as well.

2.4 California State Parks Trail Design Guidelines

CSP has prepared updated draft trail design guidelines that expand on and update the current *California State Parks Trail Handbook* (CSP 1994). These newer guidelines include improved standards for sustainable trail design and specific guidelines for design of pedestrian, equestrian, mountain bike, and multi-use trails. The draft guidelines include standard design principles to ensure that trails are suitable to the natural environment and can comfortably accommodate the types of uses that are allowed. These guidelines are in current use by CSP staff and will be incorporated into an update of the *Trail Handbook*, which is expected to be issued within one to two years. Previously unpublished relevant portions of the draft updated CSP trail design guidelines (CSP guidelines) are included in Appendix G of this Study, along with relevant portions of the current CSP *Trail Handbook* (1994).

These CSP *Trail Handbook* and guideline excerpts include:

- Current trail classifications and related criteria;
- Trail design guidelines for overall suitability and sustainability;
- Guidelines for multi-use trail design, and;
- Guidelines for use-specific trail design, including mountain bike trails, and equestrian trails.

The Study research identified and evaluated design guidelines documents from many other agencies and organizations for their relevance to CSP trail settings and policies. The objective was to identify measures for accommodating different user types and minimizing conflict on multi-use, natural-surface trails. Design principles in the CSP guidelines often parallel the principles contained in other multi-use trail design guidelines or standards. CSP guidelines are listed in the measures, where applicable. In other cases, where CSP guidelines are inconsistent with another agency's approach, the CSP guideline measures are used, while measures from other guidelines are listed for comparison.

Design for Low-Impact, Low-Maintenance, Sustainable Trails

The current Study is focused on addressing trail use conflict, and does not seek to address design for landform, climatic conditions or the direct environmental or resource impacts of use. Sustainability is an important design consideration for trails in general, including for multi-use trails. A sustainable trail is designed, constructed or reconstructed to a standard such that it does not adversely affect natural and cultural resources, can withstand the impacts of the intended users and the natural elements while receiving only routine or periodic maintenance. It meets the needs of the intended users and encourages them not to deviate from the established trail alignment. Conversely, a trail that has become eroded, muddy, or rough due to poor siting, design, or the impacts of use, could increase trail use conflicts.

CSP trail design guidelines thoroughly address these basic trail factors, which are critical to providing trails that are suitable for the setting, environment, and intended use. There are a number of trail design principles that are commonly cited in trail design references to achieve low-impact, low-maintenance, sustainable trails. The literature review contained in Appendix B indicates whether the guidelines reviewed addressed design in the context of environmental suitability/sustainability. The CSP trail design guidelines exemplify these principles. As part of the overall Road and Trail Change-in-Use Evaluation Process Program EIR, a separate study of erosion potential and control has been prepared to support the Process (Pacific Watershed Associates 2011). This erosion study will also be used to support CSP trail design guidelines, and update the *Trail Handbook*.

2.5 User-Specific Design Considerations

Designing successful multi-use trails requires an understanding of the specific needs, tendencies, and limitations of each user type. CSP trail design guidelines and other design references cover this subject thoroughly. The following paragraphs summarize these considerations as context for the conflict avoidance/reduction recommendations that follow.

Hikers

Hikers are the most flexible trail users and allow the broadest trail designs. Traveling by foot allows hikers to adjust to varying trail conditions, travelling over trails that are extremely steep or barely evident. Hiking trails generally traverse all types of environments, land capabilities, grades and surfaces. While hikers can impact

the trail and surrounding resources, upgrading or adding structures to manage impacts of a hiking-designated trail is less problematic than for equestrian or mountain bike trails.

There are baseline design standards for hiking trails in the current CSP Trail Handbook and many other design references. The additional measures to accommodate equestrian and/or mountain bike access are the focus of the Low-Conflict, Multi-Use Trail Design Checklist.

Mountain Bicyclists

CSP design guidelines state that trails open to mountain bikes are intended for the use of the trail to visit unique park resources. Mountain bikers often desire challenging trail experiences including narrow single track, rough or loose surfaces, turns, and relatively steep grades. Aided by ever-advancing technology for light weight, power transfer, traction, and suspension, many mountain bikers are "pushing the envelope" of speed and obstacle negotiation capability. Mountain bikers can attain high rates of speed, particularly on wide trails with good sight lines, flat or downhill grades, and few obstacles. It is not CSP policy to provide trails for fast, highly technical, or adventure rides for mountain bicyclists within the State Park System.

As outlined in the Study findings, mountain bikers' speeds are the primary reported cause for multi-use trail conflicts. Speed increases the chance that mountain bikers may fall off their bicycle independent of colliding with an object, particularly at turns with loose surface material or steep cross-grades. Speed leads to increased incidents with other users, single-use accidents, and perceptions of user conflicts, particularly if the mountain biker fails to provide adequate warning or passing space, or fails to yield right-of-way to other users. Thus, design of appropriate multi-use trails that include mountain bike access needs to emphasize bike speed control. The CSP trails emphasize speed control in their designs, and this is reflected in the current CSP trail design guidelines.

Mountain bike industry or user group design guidelines and management documents do not always explicitly emphasize speed control, but they often include measures that accomplish this, while placing an emphasis on adding technical challenge over controlling speed. Some of these speed control measures are appropriate in CSP settings, but many technical challenge features suggested by user groups and in some public agency design guidelines are inappropriately artificial and/or inconsistent with CSP policies for trail use in the State Park System. A trail open to mountain bikes in a CSP setting will not approach the challenge level (i.e., steep slopes, obstacles, or sudden turns) that may appear on "technical" or "challenge" trails constructed or allowed by some agencies, or featured in mountain bike parks. CSP trails are designed to place the emphasis on the user access to allow an appreciation of the natural setting and resources, rather than the mode of travel. Trails designed to be more challenging, such as those outlined in mountain bike user group guides and some agency references, may be feasible in California State off-highway vehicle areas, or potentially in California State Recreation Areas (SRAs) that are designated for more developed recreation facilities and uses. Mountain bike parks, such as at ski resorts, are helping to meet the demand for challenge and speed. In any case, design for such specialized use trails is outside the scope of this Study.

Although design to accommodate mountain bikes, including speed control features, is important, to make multi-use trails work, mountain bikers need to be aware of and cooperate with the type of use that CSP trails are intended to accommodate. CSP trail information emphasizes this, and the recommended trail use conflict management measures will help to reinforce this.

Equestrians/Horses

The inherent characteristics of horses are important to understand when considering trail use conflict issues involving equestrians. For instance, horses are herd animals and have the instinct to run when frightened. The U.S. Forest Service (USFS) *Equestrian Design Guidebook for Trails, Trailheads, and Campgrounds* states that horses and mules are prey animals, and flight is their primary defense (USFS 2007). They become nervous when escape routes are narrow or blocked and can startle when spooked when something comes by them unexpectedly and/or quickly. Any new element that is unfamiliar to the horse, such as a mountain biker, dog, llama, or even a hiker, can trigger this startle instinct, particularly when they appear suddenly. This can lead to a horse running, jumping, turning quickly, kicking, or biting. Because of the height at which equestrians ride, they can be seriously injured if they fall from a horse.

Given these characteristics of horses, other users using equestrian trails must yield the right-of-way. All equestrian trails should have signs that explain right-of-way protocols. When approaching a horse, other users should make themselves as visible as possible, not approach too rapidly, and speak in a low and friendly voice to ensure recognition. Other users should select a wide spot in the trail or an area with a gentle side slope and step off to the downhill side of the trail. Most equestrians prefer to have the uphill side of the trail during an encounter in case the horse bolts. When the horse approaches, other users should not make any sudden movements and should maintain their conversation. The hiker or biker should not step back on the trail until the horse is a full body length down the trail.

Equestrians also have responsibilities to comply with appropriate multi-use trail behavior. A horse that is inexperienced with encountering other types of trail users, especially in combination with an inexperienced rider, can be a hazard to other trail users, even if other users comply with trail use rules and guidelines.

2.6 Checklist for Low-Conflict, Multi-Use Trail Design

The Checklist for Low-Conflict, Multi-Use Trail Design presented below includes explanations and reference to relevant elements from guidelines and standards identified in the national research, and in some cases incorporates them. Design standards from the CSP guidelines are used in preference to guidelines from other agencies and organizations where there is any conflict.

These recommended measures are specifically tailored to apply to CSP trails. They are presented in an annotated checklist form that explains and lists the key design principles identified in CSP trail design guidelines and, where applicable, other Study research trail design guidelines, as effective for accommodating the individual user types and reducing conflict between users on the CSP natural-surface trails, particularly the nature-oriented trails that CSP facilities are intended to provide. The Checklist identifies the specific design standards for multi-use trails as they relate to mountain bike and equestrian use. .

The streamlined Checklist provided in Appendix A is reduced to a succinct list of recommended measures to allow CSP staff to quickly review it as part of the Road and Trail Change-in-Use Evaluation Process. The annotated Checklist in this chapter provides greater detail for completing the evaluation of conditions and needed actions. Many of the design evaluations are not simple measurements or "yes" or "no" answers; they involve careful study and consideration of multiple factors. The Checklist (either streamlined or annotated) will help to ensure that conflict-reduction objectives are considered in the Process, along with the basics of trail layout, design, and environmental protection.

The design recommendations include nine interrelated elements that support low-conflict multi-use natural surface trail design:

- **Tread Width and Passing Space**. Provide sufficient width of the trail tread and existing or created space to allow users to pass each other, either as a continuous condition, or as passing spaces at defined intervals. This also includes vertical clearance from overhanging trees and objects.
- **Sight Distance**. Include adequate length of the trail visible ahead to the user. This is particularly important to resolve in conjunction with speed control features, turns, and sinuous layout as sight distance increases as speeds are reduced.
- **Turn Radius**. Create a minimum inside radius of turns to ensure that they can be comfortably negotiated.
- **Sinuosity**. Lay out a trail with many curves and minimal straight sections (however, with sufficient sight distance). This helps limit the speed of mountain bikers and other users.
- **Speed Control Features.** Install pinch points, choke points, trail anchors, technical trail features, 'stiles', and other elements specifically designed to limit users' speeds and increase sight distance.
- **Surface Texture**. Design the relative smoothness, evenness, and firmness of the trail tread to moderate travel speed by mountain bicyclists, including the presence of irregularities.
- **Low Trail Structures**. Avoid steps and waterbar structures that constrain access for horses and mountain bikers and can create points of conflict.
- **Gradient**. Apply design limits or variations in the gradient of the trail to allow for multiple uses.
- **Trail Layout and Classification**. Consider suitability for multiple uses, factoring the level of use of the trail, availability of alternative trails and routes, and the potential for trails to primarily serve one or multiple user types.

It is important to emphasize that these elements must be combined carefully to work in concert with each other and with other trail design objectives – too much emphasis on one element could detract from other objectives. Relationships between the design elements are highlighted below.

Generally, when more measures can be checked off, the trail will be more appropriate for multi-use; however, there is no specific passing score or correct combination of measures – each trail project is unique.

2.6.1 Terminology

The CSP trail design guidelines and other standards and guidelines use specific terms to define different parts of trails or the setting for trails. The following definitions include terms used by CSP and other common trail design terms used in the recommended measures.

Clear area	Continuous, linear zone around trail free of obstruction to allow for safe, unimpeded travel.
Clearing height	Vertical clearance of obstructions across the width of the trail.
Trail bed or tread width	The width of the relatively level graded area created or utilized for the trail. In many cases the graded edges of the original trail bed slough so that the available width for the trail tread is reduced.

Trail corridor/ right-of-way	The width and boundaries where a trail is following a physical corridor, such as a road right-of-way, utility corridor, or former rail line, and/or a defined access easement corridor.
Trail shoulder	Natural surface, graded area, contiguous and flush to the trail tread, allowing a transition from the tread to natural terrain.
Trail tread	Actual surface portion of a trail upon which users travel excluding the backslope, ditch, and shoulder.
Hillslope, sideslope	The steepness of the slope on which the trail is constructed, or the resulting slope steepness adjacent to the trail after construction.
Front-country	Park areas that are within or close to urban areas. Many users are able to visit.
Back-country	Park areas that are relatively remote, and fewer users will be able to visit because of distance from trailheads and terrain.
Singletrack	Singletrack is a trail that is only wide enough for one person or mountain biker at a time. Singletrack is the most popular or sought after type of mountain bike trail.

2.6.2 Tread Width and Passing Space

A wider trail makes it easier for users to pass each other easily and safely. However, a wider trail may facilitate higher speeds by mountain bikers. Some agencies tend to restrict mountain bikes to "fire roads" and other road-width trails, because there is more room for passing and because there is generally better sight distance. These conditions may result in fewer complaints from other users, in part because these trails are less popular with mountain bikers and they may experience less use. Many mountain bikers seek "single track" trails for their interest, challenge, and better foreground scenery – the same reasons they are sought by other trail users. There is a trend among some agencies toward accommodating mountain bikes on narrower trails, which addresses demand for single track. Single track trails can also be designed to control bike speed more effectively than wide trails, but it is important that adequate passing space and sight distance are available. Singletrack trails would not be a component of CSP's multi-use trail system.

The availability of passing space is more important than the continuous width of the trail tread; both trail tread width and trail bed widths affect the users' ability to safely pass each other.

Measures

Front-country Trails:

1. Where mountain bikes are accommodated, but not equestrians: minimum tread width is 30 inches;
2. Where equestrians are accommodated: minimum tread width is 48 inches;

3. Where hillside slopes are steep, passing spaces are provided at regular intervals (the interval depending on the sight distance available):
    - A minimum of 48 inches wide and 60 inches long where mountain bikes are accommodated, but not equestrians;
    - A minimum of 60 inches wide and 60 inches long where equestrians are accommodated

Back-country Trails:

1. Where mountain bikes are accommodated, but not equestrians: minimum tread width is 18 inches;
2. Where equestrians are accommodated the minimum tread width is 36 inches;
3. Where hillside slopes are steep, passing spaces are provided at regular intervals (the interval depending on the sight distance available):
    - A minimum of 36 inches wide and 60 inches long where mountain bikes are accommodated, but not equestrians;
    - A minimum of 60 inches wide and 60 inches long where equestrians are accommodated

References

Unpublished CSP trail design guidelines (see Appendix G)

Other References:

- To allow hikers, equestrians, and mountain bikers to pass each other on the trail tread, some agencies recommend that the tread should be at least four feet wide (48 inches) (Portland Parks and Recreation, Santa Monica Mountains Area Recreational Trail Coordination Project), (Bondurant, Thompson, et. al. 2009); while others recommend a three-foot minimum (36 inches) (Midpeninsula Regional Open Space District 1993; Minnesota Department of Parks and Recreation; Santa Clara County Parks).
- Narrower trail width is part of a suite of speed control elements that are important for safe shared trails, and also minimize erosion (California Equestrian Trails and Land Coalition 2005). Alternatives to a continuous wide tread include:
    - Build a wide bench that is allowed to overgrow or clear a gentle hillslope (e.g., 20 percent or less) to act as stable shoulder for passing (Santa Clara County Parks; City of Portland Parks and Recreation 2009).
    - Provide passing areas approximately every 1,000 feet (CSP Accessibility Section 2005; Bondurant, Thompson, et. al. 2009). For equestrians, these should be five feet wide by 10 feet long to allow a single trail animal to pull off the tread (USFS 2007).
    - Particularly on trails with treads narrower than three or four feet, maintain good sight distance to make users aware of other trail users in advance.

2.6.3 Sight Distance

Similar to drivers on public roadways, trail users must be able to see ahead a sufficient distance to have time to slow down or stop, or warn and safely pass one another. Effective sight distance is, therefore, a function of

user speed; where users are traveling relatively quickly, additional sight distance is required. Also, because some horses tend to be easily startled, additional sight distance is warranted where they are present, especially when sharing the trail with mountain bikes. Other animals, as well as hikers, can frighten horses, so the issue does not exclusively pertain to bikes. However, objectives for adequate sight distance are closely related to limitation of bike speed. CSP trails are not intended for challenge or speed-oriented riding, and a 15-mph speed limit applies to CSP trails statewide. This is the assumed design speed for sight distance, and it is a speed limit consistent with the intended use of the trails for access to and appreciation of nature. Riders who exceed this limit are engaging in inappropriate trail behavior, which is the subject of the Trail Use Conflict Management Checklist.

None of the natural-surface trail design guidelines reviewed provided a data-derived basis for their sight distance recommendations, though sight distance was commonly identified as a critical consideration. The closest approximation of science-based sight distance standard is contained in the Caltrans Highway Design Manual section for paved bike routes in Figure 1003.D (Caltrans, 2009). This chart shows the relationship between speed, slope, and coefficient of friction in calculating sight stopping distances. Although the coefficient of friction may be lower on natural-surface trails than on asphalt, mountain bikes with wide knobby tires may actually attain more friction than road bikes with very narrow tires. Given the great variation in natural surfaces, and difficulty of creating and maintaining a surface with a specific standard for coefficient of friction, sight distance standards for natural-surface trails comparable to the paved trail standards may never be practical. Nevertheless, this subject deserves technical study to at least evaluate the range of sight distances that may be appropriate for natural-surface trails.

While adequate sight distance is needed, long straight sections with long, clear sight distances can also facilitate mountain biker speed. This can be an issue particularly on downhill rides, if other measures are not present to control speed.

Measures

Where mountain bikes are accommodated:

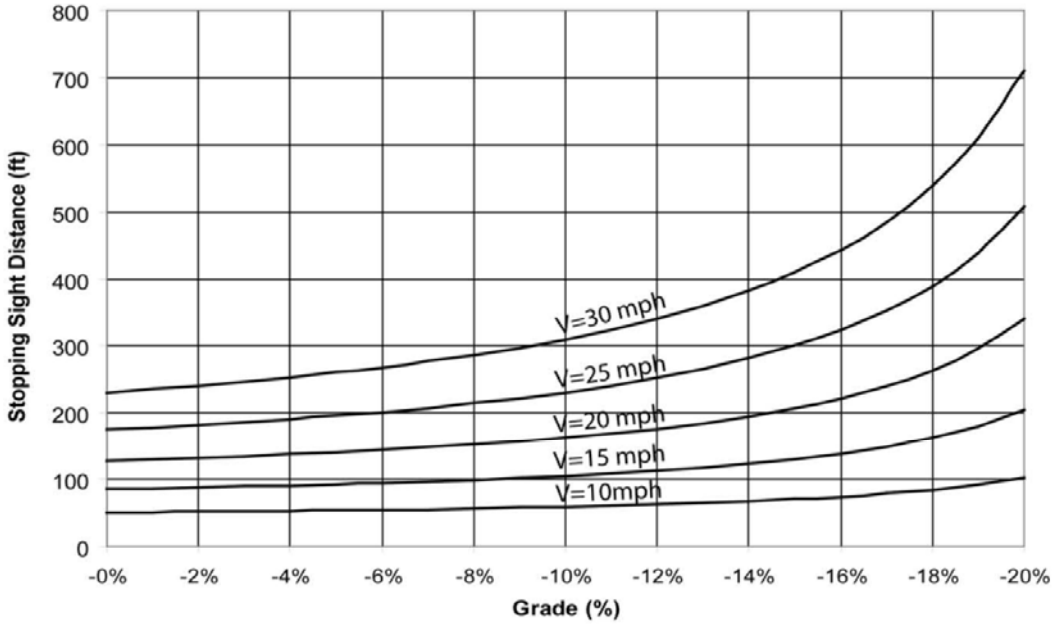
1. Sight distance of between 80 to 200 feet is provided, increasing in proportion to the percent of slope of the trail gradient (0 to 20%+). This assumes that a 15-mph speed limit is posted and generally enforced.
2. Where turns and/or speed control features are in place on a trail segment such that bike speed is controlled below 15-mph, sight distance may be reduced within that segment (but not the portions approaching).

Reference

Caltrans Highway Design Manual – Chapter 1000, Bicycle Facilities (2009)

Other Relevant References:

- Provide a 100-foot average sight distance (USFS 2007; Santa Clara County Parks Department; Flink, Olka, and Searns 1993; Midpeninsula Regional Open Space District 1993).
- Maintain sight lines by regularly thinning overgrowth, especially near curves and speed control elements (Flink, Olka, and Searns 1993; Wade County Parks and Recreation; Front Country Trails Multi-Jurisdictional Task Force).



$$S = \frac{V^2}{30(f - G)} + 3.67V$$

Where : S = Stopping sight distance (ft)
V = Velocity (mph)
f = Coefficient of friction (use 0.25)
G = Grade (ft/ft) rise/run

Figure 2-2. Caltrans Highway Design Manual Figure 1003.D – Stopping Sight Distance – Descending Grade (for paved multi-use paths)

Note: This Stopping Distance/Sight Distance chart applies to paved paths. It illustrates the relationship between factors that need to be considered in combination to determine Stopping Sight Distance on paths or trails in general – particularly the need for increased distance with increased speed and/or grade. Given the great variation in natural surfaces, and difficulty of creating and maintaining a surface with a specific standard for coefficient of friction, such specific sight distance standards for natural-surface trails may never be practical. However, paved paths also have friction and surface variation due to rain, leaves, pavement type and condition, and the above table represents an accepted generalization. This table may provide a template for possible future technical study of Stopping Sight Distance on natural surface trails. A 15 mph design speed may be appropriate, given the prevalence of a 15 mph speed limit/guideline on public multi-purpose trails.

2.6.4 Sinuous Layout

Sinuous trail layout refers to trails with many curves and few, if any, long straight segments. Curves are often necessary to follow the natural topography and geographic features, and to be in concert with the sustainable trail design principle of small trail watersheds. They also can create a more varied and enjoyable trail experience for all users. Curves and turns can be introduced where they are not otherwise required to slow mountain bikes speed.

The "right" extent of sinuosity in a trail cannot be specified outside of the trail setting; some curves are facilitated by topography, or can be routed around groves of trees, rock outcroppings and other natural features. Introduced curves should blend into the natural landscape, at least when trailside vegetation matures. Trees or shrubs can be planted or logs placed to help reinforce the need for the curve.

While sinuous layout is primarily a speed control measure for bikes in the context of reducing trail use conflict, it also helps limit hiker and equestrian speed (e.g. trail running and galloping). Further, all trail users tend to enjoy a more sinuous trail, because they tend to offer more interesting views and varied experiences, compared to long, straight trail sections.

Sinuous, curving alignments need to be designed or reviewed to ensure that adequate sight distance is provided around curves.

Measures

Where mountain bikes are accommodated:

1. The trail avoids long, straight segments (particularly on long downhills);
2. The trail follows a curvilinear alignment with numerous turns created by contouring around the landform, around trees and rock outcroppings, and dipping in and out of drainages.

Where equestrians are accommodated, but not mountain bikes, or even on hiking-only trails, sinuosity can be a desirable feature, but is not as high a priority.

Reference

Unpublished CSP trail design guidelines (see Appendix G)

Other Relevant References:

- Follow the natural contour of the land, gaining or losing elevation by crossing contour line obliquely, using trail anchors and pinch points, or by weaving the trail between trees and other features (IMBA 2007; Jefferson County Open Space).
- While sinuosity is recommended, turns should not be sudden or too tight for users to safely negotiate, and adequate sight distances must be provided. To accommodate equestrians, turns should have a minimum radius of five feet, with six to eight feet preferred (USFS 2007).

2.6.5 Turn Radius

Turn radius is the minimum inside radius of a turn in the trail that the average user can comfortably negotiate. Trail layout in hilly or mountainous terrain requires climbing turns (preferable, if the terrain is moderate enough to allow) and if necessary, switchbacks. Minimum turn radius is an important design criterion for trail turns and switchbacks, sinuous trails, and introduced speed control features. Horses are generally the controlling factor in turn radii for multi-use trail design.

Measures

Where mountain bikes are accommodated, but not equestrians:

1. Minimum turn radius is four feet for switchbacks (three feet for climbing turns);
2. Grade of the upper and lower leg of the turn does not exceed 14 percent, unless the material is durable enough to support a steeper grade, but in no case should grade exceed 20 percent.

Where equestrians are accommodated:

1. Minimum turn radius is five feet.
2. If the trail is used by pack stock, the minimum radius is six feet.
3. The grade of the upper and lower leg of the turn should not exceed 14 percent, unless the parent material is durable enough to support a steeper grade.

Reference

Unpublished CSP trail design guidelines (see Appendix G)

Other Relevant References:

- Hiking/mountain biking/equestrian trails: turn radii should be 10 feet minimum (City of Portland Parks and Recreation 2009)
- On trail curves and turns, the minimum comfortable radius is 5 feet. When turns are any tighter, stock may stumble over their own legs. Turns with a radius of 6 to 8 feet are more comfortable for both animal and rider. (USFS 2007)
- The minimum suggested radius for a climbing turn is 20 feet (6.1 meters). Climbing turns work best when built on slopes of 15 percent or less. In steeper areas, switchbacks are a better choice. (USFS 2007)

2.6.6 Speed Control Features

These features have many different terms and design concepts in the literature, but the common theme is slowing user speed; with the focus typically on mountain bikes. If designed in concert with natural topography, trees, shrubs, rocks and other site elements, these features can make the trail more interesting for all users, and avoid an introduced appearance. In the literature and practice, many of these features involve literal "choke points" or "pinch points" where the trail narrows between natural features or relocated natural materials, and users are required to weave through a series of features. Another term for a trail segment with several such tight turns is a "chicane". Some user group and agency guidelines recommend installing challenging obstacles, such as narrow bridges, log jumps, and ramps to slow user speeds and/or create challenge. In a CSP setting these "challenge" or technical features are inappropriate. Speed control features must be designed to be easy for the average user to negotiate, and should not have the form or function of an artificial obstacle or challenge. Elements should be placed so that they provide more of a visual "pinch point" than a literal narrowing (see Figure 2-3). In other words, the trail width is maintained, but viewed from a distance the trail appears narrowed; users cannot travel in a straight line to negotiate the section of trail.

Adequate passing space at appropriate intervals, as well as appropriate sight distance, must be provided in conjunction with the speed control measures.

Measures

Where mountain bikes are accommodated:

1. Otherwise straight trail sections are modified by using natural features such as trees or rock outcroppings, or relocated natural materials such as rocks or logs, to create curves and turns such that users must make a series of turns to negotiate the section,
2. The speed control features are substantial enough in volume that users can easily see them and will not accidentally or deliberately run over them (e.g., 3 to 4 feet high and 4 to 6 feet wide). They are constructed of rocks, logs, or root wads, and may include introduced or naturally occurring native vegetation;
3. They may be combined with a soil mound, but do not consist entirely of a soil mound, as this could be used as a jump;
4. They blend into the natural landscape, at least when trail construction and associated vegetation matures.

Where equestrians and mountain bikes are accommodated:

1. As above, plus a horse can easily negotiate the features (turn radius, width, clearance).

Reference

Unpublished CSP trail design guidelines (see Appendix G)

Other Relevant References:

- The trail 'flow' can be adjusted with anchors, turns, choke points, and surface textures to control speeds (IMBA 2004 and 2007). Speed control features include 'Speed chokes' (Wake County), 'Technical trail features' (Lake Tahoe Basin Management Unit), and pinch points (IMBA 2007; CSP Santa Cruz District) or stiles (Goldstein 1987).
- When designing a trail, leave selected large elements, such as trees or large rocks, and weave the trail around these 'anchors' (IMBA 2007; Wake County Lake Tahoe Basin Management Unit).
- Place two large rocks or halves of a fallen tree on either side of the trail with sufficient space for users to pass (IMBA 2007; Goldstein 1987; CSP Santa Cruz District).
- Maintain good sight lines in advance of speed control features to allow users to slow down in anticipation (IMBA 2007).
- Provide passing areas where users can wait if the feature allows only one user to pass at a time (IMBA 2007).

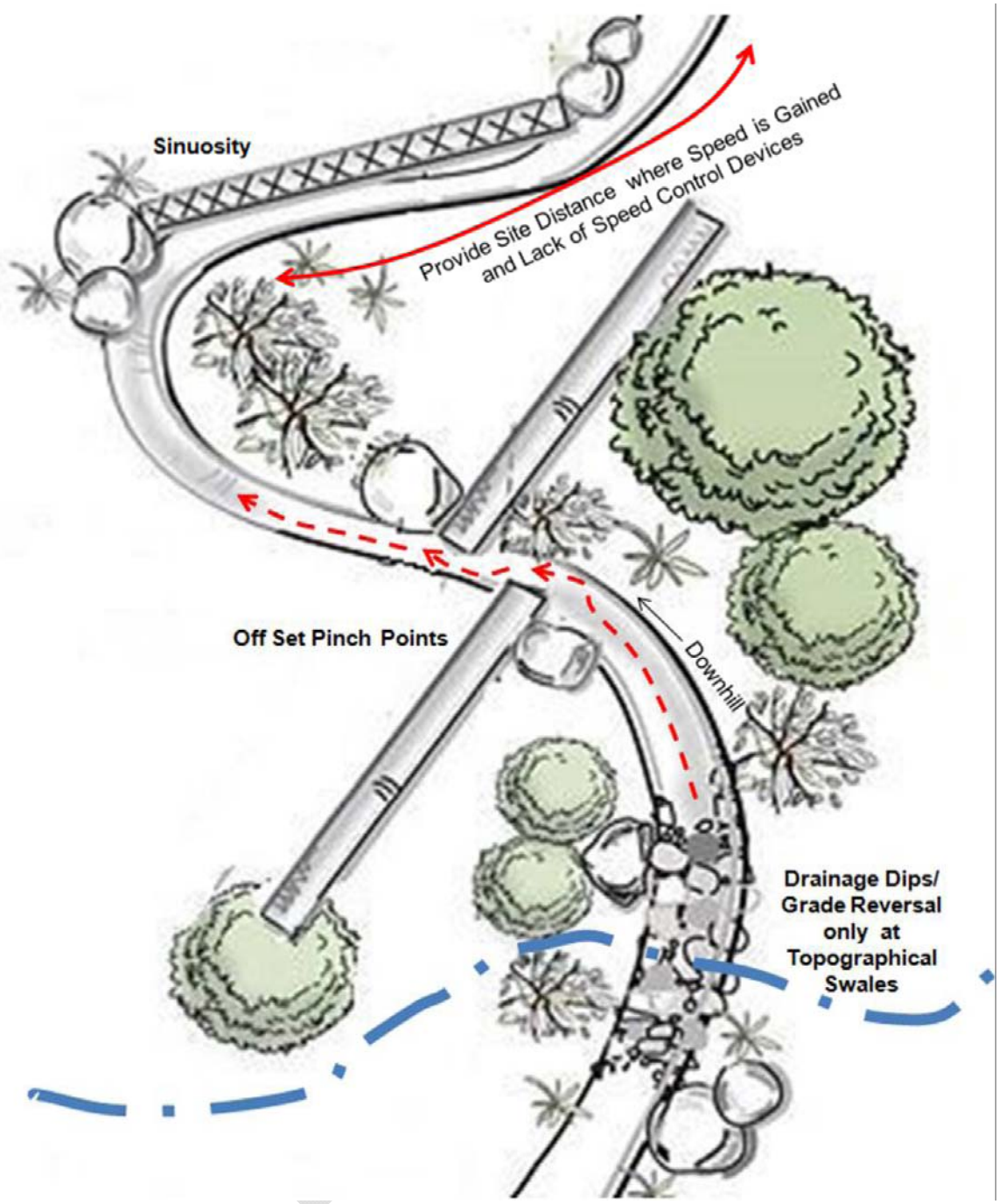


Figure 2-3. CSP Speed Control Measure Concepts

2.6.7 Surface Texture

Surface texture is important for trail safety. There are standards for the relative smoothness, evenness, and firmness of the trail tread and presence of irregularities. CSP and other trail design guidelines pay close attention to soil type, bedrock geology, and drainage to create and maintain a trail that will have a relatively smooth, even tread. However, surface irregularities can be a means of controlling mountain bike speed. Irregular surfaces are, within limits, desirable to many trail users, including hikers, equestrians, and mountain bikers, as part of a more natural trail experience. In some cases, rocky terrain or frequent tree roots dictate that there will be surface irregularities. In other cases, they can be deliberately retained. Retaining such irregular surfaces may be inappropriate, however, on more heavily used front-country trails, because there are a lot more users and more of them tend to be novices.

Measures

On back-country trails where mountain bikes are accommodated:

1. Where native rock is encountered during construction, a portion of that rock can be retained within the tread (textured or roughened surfaces), provided it does not impede overland sheet flow or present a tripping hazard;
2. The surface is fixed and presents a firm, non-slip surface (not loose, slippery or rolling);

Where equestrians are accommodated, the surface does not present sharp edges that may injure horses' hooves.

Reference

- Modify surface texture by placing rocks in the tread or using an uneven but stable material to control mountain bikers' speeds on trails (IMBA 2007).
- Maintain good sight lines and gradually transition to a change in surface texture or obstacle to allow users to slow down in anticipation (IMBA 2007).
- Unpublished CSP trail design guidelines (see Appendix G)

2.6.8 Low Trail Structures

Low trail structures, such as steps and waterbars, should be avoided on mountain bike and equestrian trails. Mountain bikers and horses have a difficult time negotiating these structures (especially mountain bikers riding uphill), and often ride around them, which can damage the trail or resources along the trail. These structures can be areas where conflicts between users occur. In any case, waterbars are not an effective drainage solution and should be a design solution of last resort.

Measures

Where equestrians or mountain bikes are accommodated:

1. Steps and waterbars are avoided, if possible. They should be design solutions of last resort.

Reference

Unpublished CSP trail design guidelines (see Appendix G)

2.6.9 Gradient

CSP trails are designed for users enjoying the natural resources, and grades should be determined by the land capability, climate, season of use, frequency of use, and canopy cover. Abrupt trail gradient changes cause hard braking by mountain bikers and greater hoof pressure by horses, which impacts the trail tread and could cause a loss of control in the case of bikers, a potential conflict-generating issue. Many of the studies and guidelines identified in the research address maximum gradients as a desirable principle for general multi-use trail design and, in some cases, as a means of controlling mountain bike speed. CSP trail design guidelines and practices do not include specific gradient limits, reflecting highly varied topographic and other site conditions that are the setting for CSP trails, and in response to the policy that the trails will conform to the natural landform and provide an experience of the natural setting.

Measures

Where equestrians or mountain bikes are accommodated:

1. Abrupt gradient changes are avoided. There is a gradual transition from steeper to gentler portions.

Reference

Unpublished CSP trail design guidelines (see Appendix G)

Other Relevant References:

- Build a small rise or minimize grade (10 percent maximum for extended lengths) to slow users at intersections and in locations with poor sight lines such as trail junctions or ridges (East Bay Regional Parks District (EBRPD) 2011; Santa Clara County Parks).
- Avoid abrupt changes in grade and fall line trails, which exacerbate erosion (USFS 2007; Hesselbarth, Vachowski, and Davies 2007).
- Grades should generally be 0 to five percent slope, with a maximum of up to 12 percent, as needed. (City of Portland Parks and Recreation 2009).
- Hikers, mountain bikers, and equestrians can comfortably and safely negotiate different maximum grades on a trail. For an accessible trail, the slope perpendicular to the direction of travel, the cross slope, shall be five percent maximum (CSP Accessibility Section 2005). The USFS *Trail Construction and Maintenance Handbook* recommends slopes of 15 percent or less on climbing turns (Hesselbarth, Vachowski and Davies 2007), while *Trail Planning for California Communities* states that 'wildland trails' should have a 12.5 percent maximum slope (Bondurant, Thompson, et. al. 2009). IMBA uses a maximum of 7 percent side slope grade for climbing turns and cites the 10 percent average guideline for sustainable trails (IMBA 2004).
- The USFS *Equestrian Design Guidebook for Trails, Trailheads, and Campgrounds* (2007) states that equestrian trails can be as steep as 20 percent grade for no more than 200 feet, otherwise switchbacks should be considered to minimize erosion. On running grades steeper than 5 percent, six to 12 inches of extra tread width should be added as a safety margin where possible (USFS 2007).

- The City of Portland recommends that hiking/mountain biking trails and hiking/equestrian trails should have grades of zero to five percent slope or up to 12 percent, as needed (City of Portland Parks and Recreation 2009). Similarly, California Equestrian Trails and Land Coalition (CETLC) recommends keeping the slope as low as possible (preferably under 12 percent if possible) to allow safe places for passing and visibility (CETLC 2005).
- On running grades steeper than five percent, six to 12 inches of extra tread width should be added as a safety margin where possible (USFS 2007). Also, when trails have outslopes of four to five percent, widening the trail an additional six to 12 inches (152 to 305 millimeters) helps stock stay in the center of the tread (USFS 2007).

2.6.10 Trail Layout and Classification

Trail layout and classification measures do not address trail system layout in detail, a subject that is well covered in the current CSP Trail Handbook and other references. Trail users generally prefer loop trails to "out and back" routes. Bicyclists, and to a lesser extent equestrians, tend to desire longer trail loops than hikers. With equestrians, loop trails are important because a horse can become "barn sour" when retracing a path. When horses know they are heading back to camp or a trailhead, they sometimes get anxious. Knowing that food, water, the company of other horses, and the relief of not carrying riders is close at hand, can cause them to pick up their pace and become difficult to handle, potentially resulting in trail use conflict. This behavior is reduced when riding loop trails.

The context and classification of the trail influences the types and levels of use the trail receives, and these are important considerations for appropriate design and for conflict management. Information on CSP trail classification is provided in Appendix G.

When other public lands and trails connect or are nearby to the CSP unit, the trail's role in the overall regional trail system also needs to be considered. Trails that are a main connection to destinations or that function as connector trails to a series of loops are likely to experience more use than more remote trails. Trails near trailheads experience the highest level of use and a higher level of design may be needed to accommodate multi-use.

These layout and classification considerations are strongly related to options for managing trail use discussed in the Trail Conflict Management Checklist under Separate Trails and Specialized Trails.

Measures

1. The review of the trail use change proposal considers the trail's classification and role in the park unit trail system, and where applicable, the regional trail system. This includes the availability of alternative routes to trails that are otherwise open to the use being studied for addition, and the anticipated level of use.

Reference

Unpublished CSP trail design guidelines (see Appendix G)

Other Relevant References:

- Categorize trails according to a classification system such that trails that are anticipated to accommodate more users have a higher level of design, such as width or passing space, frequency of

speed control features, etc. (Forest Service, 2007; Marin Regional Open Space District; East Bay Regional Parks District City of Portland Parks and Recreation and Santa Clara County Parks Department).

- Provide loop trails or an arterial shared-use trail leading to single-use trails (IMBA 2007; Chavez 1996a).
- Consider mileage of trails available for each use type when evaluating whether to open or close a trail to a user group. Provide sufficient alternatives to prevent a single trail from becoming overcrowded.

2.7 Measures for Trail Use Conflict Management

The Study found that measures for influencing trail user understanding and behavior through information, enforcement, and particularly pro-active communication with trail user groups and individual users, can be as important as physical trail design to address the overall social issue of trail use conflict. The research identified a set of factors and measures that should be considered, as summarized below and detailed in other Study chapters.

The Literature Review and Agency Survey conducted for this Study found that trail use conflict is heavily based on attitudes and perception. Also, the Study found that trail users who don't follow trail rules, courtesies, or common sense often contribute to conflict perception, incidents, and potentially accidents. Similar to the highways and paved trails that are part of transportation systems, "rules of the road" must be established, understood, and generally followed to create an acceptably low-conflict, trail use environment.

The research shows that trail managing agencies and organizations benefit from taking active steps to work with the users to address trail conflict, although the results and opinions are uneven. Conflict management is much more an adaptive process, and subject to local or regional social conditions and history, compared to multi-use trail design. It also tends to be an ongoing process that is highly dependent on available staff resources at a time when resources are increasingly stretched. Nevertheless, conflict management includes an important set of tools to create and maintain multi-use trails that work for the intended users and that conform to CSP policies for trail use.

Using this Checklist requires consideration of the overall trail and trail use setting and the history, nature and relationships of the types of users involved, including specific key individuals.

The overall management principles are important to consider in this Study; specific application details will vary from project to project. The measures are intended to provide a checklist of strategies that can be undertaken to reduce the potential for conflicts on multi-use trails. The greater number of measures in place and implemented, the more likely that conflict will be minimized; however, each situation is unique.

Management measures for reducing trail use conflict are listed below.

2.7.1 Management Strategies

Direct management strategies seek to regulate behavior through sanctions or fines (enforcement) while indirect strategies provide information and education to users to influence behavior. Techniques can be subtle or obtrusive, positive or appealing to a fear of consequence. Management strategies are discussed in this section under the following six categories:

- Rules– adopted and enforceable rules, regarding staying on designated trails, right-of-way, warning when overtaking, speed limits, etc.;
- Enforcement – monitoring, warnings, radar, and citations;
- User information – information about rules, polices, and advice for trail user respect, right-of-way requirements, and courtesy; routes, destinations and conditions;
- Data tracking - collecting and tracking data on trail use conflict incidents and design or management successes;
- Separate trails and specialized trails - alternate use days, one-way trails, and designated use-intensive trails.

Rules

Typical rules include posted speeds, yielding expectations, and where and when users can be on a trail. Park agencies often have the power to cite, give warnings, or exclude users who break rules. If rules are not adopted and posted, they are not enforceable, and if they are not actively enforced, there may be greater difficulty managing user behavior. Rules should be clear, consistent, and fair with regard to the relative potential issues caused by different types of users. People are more willing to comply with rules when they understand the reasons for them. At a minimum, posted rules should include: stay on trails designated for your user type; yield to other users per the "trail right-of-way triangle;" warn when approaching/passing; and comply with the CSP 15-mph speed limit for trails.

Measures:

1. Rules are adopted and posted (see Public Information) with details of the relevant state codes so that they are clear and enforceable (see Enforcement).

Relevant References:

- A 15-mph speed limit can be posted (Santa Clara County Parks Department; CSP Gold Fields District; Jefferson County; Sacramento County); however, challenges to the use of speed limits include difficulty of enforcement, lack of enforcement staff, and users' limited knowledge of the speed they are traveling (Bondurant, Thompson, et. al. 2009; IMBA 2007).
- Focus enforcement at parking lots and use radar guns to enforce speed limits (EBPRD 2011).
- Trail offenders can be sentenced to work service on the trail as part (or all) of their penalty (Flink and Searns 1993).
- Enforce rules consistently to assure users that there is no perception of discrimination among different user groups (Flink and Searns 1993).

User Information

Having enforceable rules is a first step, but effectively communicating them and the reason for the rules is critical to achieving compliance. Relevant information should go beyond rules to include trail courtesy and safety guidelines. This includes information about the characteristics and needs of different user types, and how to behave or prepare to minimize the risk of conflicts and accidents. Examples include shared-trail training and experience for horses and riders, bells and call-out techniques for mountain bikers, and information about routes, destinations and conditions to allow users to make informed choices. Many organizations, including CSP units, have already developed public information materials that can be used and adapted. It is important that the rules and guidelines are consistent with adjacent/connecting lands and trail systems, or that the information clarifies inconsistencies.

Measures

1. Information is available regarding trail use rules and reasons for rules, courtesies, behavior and preparation, and trail designation and condition.
2. The information is posted at major trailheads in detail (e.g., on a mapboard) and summarized on signs.
3. The information is included with printed maps and brochures for the unit.
4. Consistent information is posted on the unit website, and where applicable, on local web sites (e.g., partner or volunteer organizations).

Relevant References

- Interpretation messages are as effective as sanction messages and both types are more effective than no message (Duncan and Martin 2002).
- Cite specific policies with enforceable rules and applicable penalties on signs posted at trailheads, in trail brochures, and on maps (Flink and Searns 1993).
- Maximize efficacy by addressing problem behaviors that are characterized by careless, unskilled, or uninformed actions (Manning 2003).
- Distribute information via multiple media, including brochures, personal messages, audiovisual programs, newspapers, magazines, guidebooks, trained volunteers, outfitters, commercial guides, wilderness ranger and volunteer role modeling, and design information for a variety of target audiences (Manning 2003).
- Connect with or modify visitor attitudes, beliefs, or norms and provide information on the impacts, costs, and consequences of problem behaviors (Anderson, Lime, and Wang 1998; Manning 2003).
- Enforce rules in addition to posting signs (CSP Gold Fields District; Tualatin Hills Parks and Recreation District; Mecklenburg County Park and Recreation; and City of Portland Parks and Recreation).

Enforcement

The presence of rangers or other authority figures on the trail can deter violation of rules and encourage users to follow trail etiquette and use guidelines. Ranger patrols can monitor and track issues; inform, warn and cite

users who violate posted rules; and record and respond to comments or complaints from users. Volunteer patrols (see Volunteer Programs) can support all of these enforcement efforts except citations, and in some cases have been found to be a more acceptable and less threatening form of intervention with trail users because they are at more of a peer-to-peer level. In some cases private non-profits are under contract to provide management assistance that may include this role.

Measures

1. Ranger patrol time is allocated for the trail to monitor, inform and enforce compliance with the rules, and encourage awareness and compliance with courtesy, safety and environmental guidelines;
2. An organized volunteer patrol exists or is being formed that will actively support rangers on monitoring and informing trail users.

Relevant References:

- Where speed limits are posted, have rangers enforce speeds, issue citations, or issue warnings to rule breakers (Tualatin Hills Parks and Recreation Department; City of Durango; City of Portland Parks and Recreation; Sacramento County Parks).
- Off-duty police can assist in enforcement (Mecklenburg County; City of Durango).
- Volunteers can assist with patrolling the trail, discussed in the outreach section. Volunteer patrols act as the 'eyes and ears' of a land manager and can enhance visitor experiences, assist land managers, promote trail stewardship, and respond to incidents (IMBA 2007). Volunteer patrols can also model appropriate behavior.

Public Notification and Input

When a trail use change is being considered, or any other major change in trail system conditions or operation is undertaken, it is important to thoroughly notify and involve the users and other interested parties (e.g. other agencies, adjacent property owners, and related businesses) early in the process. This pertains to the formal, project-specific planning and management process, and also to effective ongoing general coordination with the public, as discussed under Outreach and Coordination.

Measures

1. Notice of the proposal and a means and adequate timeframe (e.g. one month) to comment is posted in sources that are likely to reach the interested parties: trailheads, web site(s), local paper, park and local bulletin boards;
2. Notice of the proposal has been emailed to local and statewide user groups and contacts generated by the unit, local press, and adjacent agency contacts, etc.
3. At least one public meeting regarding the proposal has been held/ is scheduled at a time and place that is accessible to most parties, and notes of comments have been/will be created and made available to attendees and points of notification/contact.

Relevant References

- When an agency changes management practices to mitigate conflicts, public dissatisfaction with the decision-making process can be a barrier to implementing management regulations (Front Country Trails Multi-Jurisdictional Task Force – City and County of Santa Barbara, Town of Pagosa Springs).

Collecting and Tracking Data

Data on complaint or incident reports, particularly involving accidents, is valuable to determine how conflict-reduction measures are working. The data is more valuable if specific details are captured (date, time, location, weather, user types, contributing factors, outcomes). The data's usefulness is further enhanced if there are also counts or at least an estimate of trail use to provide a context about relative frequency of occurrence. Based on the scarcity of hard data in the research results, collecting and tracking such data is beyond the abilities of already strained trail management staff. It may be possible to work with volunteers to collect and manage data, but this may raise the issue of bias, if the volunteers are from one type of user or another. Educational institutions or interns may also be used to collect and analyze data. This information can promote user trust in management, thereby lowering perceptions of conflict. Ideally, data would be collected on an ongoing basis; however, collecting data before and after a major trail use change would be a higher priority.

Measures

1. Trail use and incident/accident data is collected, maintained and analyzed in an organized system, as feasible.
2. Volunteers or partners are assisting with data collection and management
3. The data is being collected and analyzed on a short-term project basis in association with the trail proposal;
4. The data is being collected and analyzed on an ongoing basis.

Relevant References

- To effectively deter noncompliant behavior, gather incident and complaint data, use estimates, and user surveys to address the reason(s) behind the behavior and not just the symptoms (Anderson, Lime, and Wang 1998).

Separate Trails and Specialized Trails

User types can be separated by designating some trails for single-use or primary-use. Some agencies have designated trails that are advertised for a particular use, where other user types are secondary or prohibited. This allows the agency to focus design criteria on accommodating a single or fewer user types, providing more flexibility, and it avoids user conflicts on the specific trail segment(s), at least to the extent that other users comply or are comfortable being secondary.

Alternate days for different user types have been designated on some trail systems, with varying level of success. One-way trails have also been established, although this raises the risks of failure to comply. These solutions are more effective on local or front-country trail systems with a more stable user base, and where agencies have the ability to inform the users in advance of the rules.

Separate trails can also be designated for different users. A shared-use feeder trail can lead to separate loop trails for different users, although having parallel but separate facilities in the same corridor may result in resource protection challenges.

Measures

This part of the Checklist does not include specific measures, as the options and their potential feasibility are very case-specific.

Relevant References:

- Designate a use-intensive trail or area (Chavez 1996a).
- Develop parallel treads in the same trail corridor if land base and/or resource concerns allow (USFS 2007).
- Use restriction management techniques include alternate use days, one-way trails, and designated use-intensive trails (Flink and Searns 1993).
- Consider implementing alternating day access, in which mountain bikers are allowed on the trail one day and hikers on another (Jellum 2007; National Park Service [NPS] 2003; Flink and Searns 1993; Jefferson County Open Space).
- Consider designating one-way trails on which mountain bikers can only ride in one direction at all times or on certain days (Jefferson County Open Space; Flink and Searns 1993).
- Other natural area management strategies have found that visitors accept use limit policies if they feel the resource requires the protection afforded by the policy (McCool and Christensen in Lime et. al. 1996)
- Restricting or prohibiting activities can be highly obtrusive and "lead to a strong sense of 'being managed' on the part of the visitor", which can result in a climate of conflict (Anderson, Lime, and Wang 1998).

Spatial Separation

- A survey of mountain bikers in National Forests nationwide found that the management strategy of providing separate trails for different users "was not regarded as a plausible solution by any of the participants."
- A common strategy to separate users who travel at different speeds is to provide parallel treads in the same trail corridor. While this practice is commonly used to separate pedestrians and equestrians from road bicyclists on a paved trail, the strategy is also employed on fully soft-surface facilities. The City of Henderson (NV) and Town of Pagosa Springs (CO) recommend providing separate, parallel equestrian trails.

Temporal Separation

- Different types of use can be allowed on the single tread at different times of day, days of week, season of the year (Flink and Searns 1993)
- A study in Chilkoot Trail National Historic Site, British Columbia found that a management strategy that excludes snowmobilers every third weekend successfully reduced goal interference while increasing skiers' satisfaction but reducing snowmobilers' (Jackson, Haider, and Elliot 2004).

- Both hikers and bikers supported an every-other-day exclusion policy in the Snoqualmie National Forest, Washington. Equestrians were not allowed on the system. (Jellum 2007)
- An Environmental Study considered alternating days when mountain bikers and equestrians were allowed on the Cactus Forest Trail in Arizona. The discussion of the alternating days scenario noted that, while the potential for conflict would be reduced, "some recreationists may feel constrained, and others may be displaced" which were considered "adverse, short- to long-term, and of negligible to moderate intensity depending on the individual" (NPS 2003).
- A survey conducted in the Jefferson County Open Space trail system west of Denver, Colorado categorized users who did not observe, but perceived a problem ("social values conflict") and those who both observed and perceived a problem ("interpersonal conflict"). The study found that more conflicts were reported about mountain bicyclists than hikers. Mountain bicyclists, hikers, and people who participate in both activities all reported more interpersonal, rather than social value conflicts. The study concludes by recommending separation between mountain bicyclists and hikers, stating that, "When the conflict stems from interpersonal conflict, zoning incompatible users into different locations of the resource is an effective strategy" (Carothers, Vaske, and Donnelly 2001)

2.7.2 Outreach and Coordination Strategies

The research has demonstrated that working with trails and user groups, holding public meetings, and educating the public has often been beneficial in reducing conflicts between users and improving safety. Outreach and coordination involve ongoing staff work with user groups, and ideally user groups working with other user groups, to build understanding and cooperative relationships to encourage compliance and minimize conflicts. These measures apply basic trail and trail use information to project-specific and location-specific communications. User group outreach and coordination can include the following strategies:

- Education – user-specific printed materials and web postings, and/or an active, focused public relations campaigns to educate users about trail use rules and appropriate behavior;
- User group relations – general (rather than project specific) meetings with user groups about trail safety or conflict-related issues, or objectives, such as making, improving and maintaining trails and making the trail experience more enjoyable;
- Volunteer programs – ongoing trail patrol and/or maintenance assistance, specific projects, and help with outreach and education regarding conflict avoidance, safety, and courtesy;
- Events –multi-user social, fun, trail construction or maintenance events (e.g. Trail Education Days).

Education

In addition to the basic information discussed under User Information, agencies can reach out to the general user population and to specific types of users to educate existing and prospective trail users about trail use rules (and reasons for the rules), courtesy and safety guidelines, and other information for safe, fun and environmentally compatible trail use. Such education is often combined with project or user group meetings, events and other activities via websites, advertising, outreach to schools, and other activities. Outreach should ideally involve two-way communications – the public can ask questions and get answers, and comments are collected and are reviewed by managers.

Measures

1. Staff or representatives (volunteers or docents) speak at local events, schools, user group regular meetings or other venues to carry overall CSP or unit messages as well as specific safety and conflict management and environmental compatibility messages.
2. Educational outreach includes collection of comments and consideration by management staff.

Relevant References

- Ranger patrols and/or volunteers should speak directly with trail users about sharing the trail (Lake Norman State Park, Jefferson County Open Space, Turlock Lake, Front Country Trails Multi-Jurisdictional Task Force).
- Target presentations of best practices of trail sharing to user groups (CETLC 2005; Flink and Searns 1993; Santa Barbara).
- Reach out to local schoolchildren through skits and trail events to inform them about appropriate trail etiquette (Conejo Open Space Conservation Agency - COSCA).
- Hold training clinics for equestrians and mountain bikers to teach the horses and riders to meet cyclists in varying situations (CETLC 2005).

User Group Relations

Agencies can work with established user groups to build public support for a trail project or management strategy. Such ongoing contact can build trust and a positive relationship because it goes beyond attendance at an occasional or project-specific meeting where tensions may already be high. These contacts can be venues for venting, initially or even permanently, but this can potentially lead to a better understanding and relationship.

Measures

1. Managers or staff regularly attend user group meetings and/or make informal general contacts on an ongoing basis.
2. Managers or staff regularly attend multi-user trail group meetings such as county trail committees, or have formed their own multi-user group and coordinate with them.
3. Volunteers or docents support staff in this capacity, representing CSP positions and reporting back to staff.

Relevant References

- Collaboration between field staff and the mountain bike and equestrian communities can create a shared sense of resource protection and stewardship between staff and user communities (EBRPD 2011).
- Create a trails committee or stakeholder group of individual trail users to gather input on the project (IMBA 2007; Chavez 1997; Moore 1994; COSCA, Vancouver-Clark Parks and Recreation Department VCPRD, Gold Fields, Bureau of Reclamation Lower Colorado Region, City of Henderson).

- Hold joint trail construction or maintenance projects and skills workshops among different users (Moore 1994).
- Hold public meetings, issues identification workshops, community design workshops, public hearings, citizen advisory committees, surveys, and mass media outreach (Moore 1994).
- Collaborate with trail groups to plan, construct, and manage trail projects (VCPRD, Oregon State Parks and Recreation, Front Country Trails Multi-Jurisdictional Task Force, Town of Crested Butte, Mecklenburg County, City of Durango, and Oregon Parks and Recreation).
- Designate a staff member to attend user group meetings and to work with particular groups on trail work days (CSP Gold Fields District).
- Maintain regular communication with different user groups and bring issues to them as necessary (Mecklenburg County, City of Durango).
- Discuss problems with affected user groups via land manager trail walks (Moore 1994).

Volunteer Programs

Agencies can work with or even form volunteer groups to maintain or patrol trails and to encourage and exhibit proper trail etiquette. This can include volunteer trail patrol to assist with monitoring and informing users about rules, courtesies and desirable practices. Working with and especially forming a volunteer group has significant time requirements. There are complex procedural, legal, and safety/liability concerns that go beyond the scope of this discussion. However, where feasible, and in favorable circumstances, volunteer groups can be tremendous resources for addressing trail safety and conflict, as well as assisting with construction and maintenance. Ideally, volunteer groups include members from all user types. Volunteer groups from a single user type are most effective working with their own peer groups. Concerns about potential bias may arise from other groups

Measures

1. Volunteer group(s) exists that take an active role in working with the CSP unit and their respective user type (indicate user groups represented).
2. A multi-user volunteer group with balanced representation from types of users exists and actively helps CSP staff to work with trail users.
3. A multi-user volunteer trail patrol with balanced representation from types of users exists and actively supports CSP staff and works with trail users.

Relevant References

- Messages from other mountain bikers are more effective in changing mountain bikers' behavior than those coming from a uniformed agency volunteer or a hiker (Hendricks et. al. 2001).
- Organize volunteer patrols or 'Trail Watch' groups to remind users of proper etiquette, model good behavior, and assist trail users with questions (IMBA 2007; CSP Gold Fields District; Jefferson County Open Space; Tualatin Hills Parks and Recreation District; CRD Parks; City of Henderson).
- Have volunteers assist with events such as trail maintenance days and Share the Trail events (Flink and Searns 1993; Bondurant, et. al. 2009).

Trail Events

Agencies can organize or facilitate public events supporting local trails, such as trail construction, repair, or maintenance work days, or events that are simply intended to be fun and social and to allow different user groups to come together in a controlled and cooperative way. These events can improve relationships and consideration between trail user groups and with CSP staff, and are opportunities to convey messages about how to avoid trail use conflict.

Measures

1. The CSP unit participates in trail events and provides information and presentation on appropriate trail use as part of their participation in the events.

Relevant References

- Hold "Trail Education Days" for students (COSCA).
- Organize trail work days that include all types of users (Moore 1994; CSP Gold Fields District).
- Encourage user groups to hold 'carrot rides' or 'Romp N' Stomp' events in which mountain bikers feed carrots to equestrians' horses (CSP Santa Cruz District; Moore 1994; IMBA 2007) or bell give-aways (City of San Luis Obispo).

Chapter 3. Research Results

This chapter presents the combined results of the Literature Review and the Agency Survey regarding the nature of trail use conflict and potential solutions. It summarizes the responses without drawing conclusions as to their applicability to California State Parks (CSP) trails, which is accomplished in the Summary Findings in Chapter 1, and the Recommendations in Chapter 2. More detailed results of the Literature Review are presented in Appendix B, and more detailed results of the Agency Survey are presented in Appendix C.

3.1 Introduction

The existing literature and the information provided in the survey responses primarily consist of the opinion of trail system managers and users. Even peer-reviewed academic or U. S. Forest Service (USFS) publications primarily rely on manager and user surveys. Few sources have used detailed data, such as complaint or incident reports, as a basis for analyzing the nature and extent of trail use conflict issues. While there is a wealth of documents and articles on the topic of user conflicts on multi-use trails, the majority of the literature does not provide empirical data regarding the presence, extent, or attributes of user conflict or incidents. While 63 of the 80 Literature Review sources define the problem of trail user conflicts, several of them do so as a presupposition based on previous literature (14 sources), or the author's experience (13 sources). Several sources present surveys on managers' perceptions of conflict (9 sources) or users' perceptions of conflict (22 sources). None of these surveys asked the frequency of actual trail use conflict-related incidents or accidents. This notable lack of citations regarding specific incidents and accidents implies that they occur infrequently.

Documentation of design challenges and solutions is also primarily based on opinion, and does not reflect empirical study or evaluation of success. However, there is a large body of practical experience and informed opinion represented in the research results, and this reflects the "state-of-the-art" in multi-use trail design and management with respect to trail use conflict.

In the following summary, where a theme was cited by a single source, or multiple agency or document sources, the reference follows. Where jurisdictions are cited without a date, the source is that jurisdiction's Agency Survey. If several sources supported the finding, the text provides general reference to support without specifically identifying all documents or agencies. These findings and the supporting documentation are presented in more detail in the Literature Review and Agency Survey presented in Appendices B and C of this Trail Use Conflict Study.

3.2 The Nature of Trail Use Conflict

The literature reviewed and agencies surveyed strongly supported the idea that conflicts between trail users are highly influenced by perception, attitude, and behavior.

U.S. Forest Service (USFS) Lake Tahoe Basin Management Unit staff noted that use conflicts are "very subjective and determined by individuals." Three agencies noted entrenched negative perceptions of other user groups arising from a history of conflict or disagreement; CSP Gold Fields District, the Front Country

Trails Multi-Jurisdictional Task Force, and Jefferson County Open Space all cited historic conflicts contributing to an environment where managers had difficulty addressing root causes of conflict perceptions.

Six percent of the survey respondents noted that the users' purpose of visiting the trail influenced their behavior; conflicts between recreationists and families were mentioned. Less frequent conflicts cited were caused by meet-up groups and running clubs or other users traveling side-by-side and blocking the trail. Comments at the Program Environmental Impact Report (EIR) scoping sessions included concerns that mountain bikers' speeds discourage equestrians and hikers from using the trails.

Conflict is commonly defined as "goal interference attributed to another's behavior," stating that users' dissatisfaction (conflicts) from a perception that other users are preventing them from actualizing their recreational goals (Jacob and Schreyer 1980). They note that this goal interference does not necessarily imply goal incompatibility; users may visit the same trail for similar reasons, despite using different modes.

More recently, Moore (1994) advanced this theory of conflict as interpersonal disagreements, writing that "conflict has been found to be related to activity style (mode of travel, level of technology, environmental dominance, etc.), focus of trip, expectations, attitudes toward and perceptions of the environment, level of tolerance for others, and different norms held by different users" (Moore 1994). Watson, a researcher with the USFS, observes that perceptions of conflict are frequently unrelated to measurable incidents of interference in outdoor recreation, but rather reflect an attitude towards wilderness and stereotypes of other user groups (Watson 2001).

Only 2 percent of users surveyed in Boulder County Parks and Open Space reported experiencing conflict on the day of the survey. One-third reported having experienced a conflict at some point in the past. Nevertheless, users reported several complaints, particularly about mountain bikers' speeds, failure to yield, and not communicating when passing (Bauer 2004). In Ohio, State Park managers and district supervisors surveyed reported concerns about mountain bikers' excessive speeds and potential for conflict with other users (Longsdorf 2006).

A 2001 survey of trail users in the Jefferson County Open Space trail system considered the extent to which conflicts between users are interpersonal (based on physical presence of other users) or social values (no contact has to occur). The survey supported the studies, finding that all types of users reported more interpersonal (physical interactions between users) than social values conflicts (Carothers, Vaske, and Donnelly 2001).

Several surveys of trail users have indicated that conflicts between users were highly influenced by perception and orientation. Research conducted in the Bridger-Teton National Forest found that users who had past experience with other trail activities experienced less conflict when encountering participants of those activities than respondents who had never done those activities before. People who had participated in an activity in the past were also more likely to report increased enjoyment due to encounters with that group than were trail users who had never done the activity before, although the relationship was less statistically significant between mountain biking and horse riding (Bradsher 2003).

A survey conducted for the report, *Perception and Reality of Conflict: Walkers and Mountain Bikes on the Queen Charlotte Track in New Zealand* (referenced in U.S. literature) indicated that pedestrians who had not encountered any bicyclists had more negative perceptions of bicyclists than those who actually encountered them (Cessford 2002). A survey in Wellington Park, Australia found that users had different goals for use of the park;

mountain bikers visited the park for 'socializing' and 'excitement/risk', while other users desired 'relaxation' (Chiu and Kriwoken 2003).

3.3 Primary Types of Conflict

Conflict issues often relate to users' perception of being unsafe, or just annoyed, due to the presence of other types of trail users. Many of the comments received from the Program EIR scoping session stated that conflict is related to mountain bikers failing to yield or passing too quickly. Similarly, common concerns related to user conflicts in both the Literature Review and the Agency Survey include mountain bikers' speeds and lack of warning and/or yielding when passing. Of the 36 surveys returned, the most frequent conflicts noted were between pedestrians/hikers and bicyclists/mountain bikers (68 percent). The second most frequent concern from the Agency Survey was related to conflicts between users with dogs and those without (41 percent). Only 18 percent cited issues between equestrians and mountain bikers, despite this being a prevalent concern in the Program EIR scoping comments.

Six percent noted that users' purpose of visiting the trail impacted their behaviors; conflicts between recreationalists and families also arose. Less frequent conflicts may be caused by meet-up groups, and running clubs, or other users traveling side-by-side and blocking the trail. Comments at the Program EIR scoping sessions included concerns that mountain bikers' speed differential discourages equestrians and hikers from using the trails.

3.4 User-Appropriate Trail Design Strategies

Design can help to minimize the occurrence of incidents, but not eliminate them. Design strategies are defined as physical trail configuration or alignment treatments intended to create a user-appropriate trail experience for designated user types. Incidents are reduced when user-appropriate designs on multi-use trails are implemented.

Design standards tend to feature general solutions that are not primarily directed at minimizing incidents on multi-use trails. Instead they focus on overall user-appropriate design and sustainability, providing dimensions and specifications for multi-use trails as an aggregate of designs for single-use trails. In this context, adequate sight lines, width and/or passing areas, and elements of design that reduce speeds are frequently mentioned in design guidelines for successful multi-use trails. Among agencies that have comprehensive design guidelines, agency staff often cited design elements that were not documented in the standards, but were based on their professional experience and practice.

In both the Literature Review and the Agency Survey, user-appropriate trail design emerged as being critical to minimizing conflict and user-perceived safety concerns on multi-use trails. In *Trails for the 21st Century*, Flink, Olka, and Searns (1993) stress the importance of designing a trail with the users in mind, stating that, "Accommodating a range of users within a single trail depends on trail width, trail surface, and speed of trail users" (Minnesota Department of Natural Resources 2006).

3.4.1 Agency Design Standards and Guidelines

In addition to their own guidelines, agencies surveyed tend to use select state or national guideline documents. The CSP districts primarily use the CSP's *Trail Handbook* (1991), while the USFS and several other

agencies refer to the USFS *Trail Construction and Maintenance Notebook*, *FSH2309.18* (USFS 2007). Several agencies also report using the IMBA manual, *Trail Solutions: IMBA's Guide to Building Sweet Single-Track* (IMBA 2004), as well as *Managing Mountain Biking: IMBA's Guide to Providing Great Riding* (IMBA 2007).

3.4.2 Trail Design Strategies

Few documents or agencies provide specific guidance for design measures to address user conflicts, although many documents and agency staff note the significance of the issue and provide general recommendations for solutions. Although multi-use trail design standards vary widely, five design approaches emerged as common themes from the literature review of design standards and survey responses from agencies and organizations that have focused on trail use conflicts on natural surface trails:

- **Adequate Width and Passing Area**– width of the trail tread and cleared space or trail bench to allow users to pass each other, either as a continuous standard, or as passing spaces at defined intervals.
- **Sight Distance** – the length of the trail visible ahead to the user. This is particularly important to resolve in conjunction with speed control features and curvilinear design.
- **Speed Control Features** – including pinch points, trail anchors, technical trail features, 'stiles,' uneven tread surface, and other elements specifically designed to reduce mountain bikers' speeds.
- **Gradient** – limits or variation in the gradient of the trail. This was often referenced as consideration for controlling mountain bikers' speeds.
- **Curvilinear /Sinuous Design** – curving layout of the trail that encourages mountain bikers to slow down, and tends to add to the natural quality and sustainability of the trail.

Figure 3-1 shows the frequency which the Literature Review and Agency Surveys referenced each of these solutions.

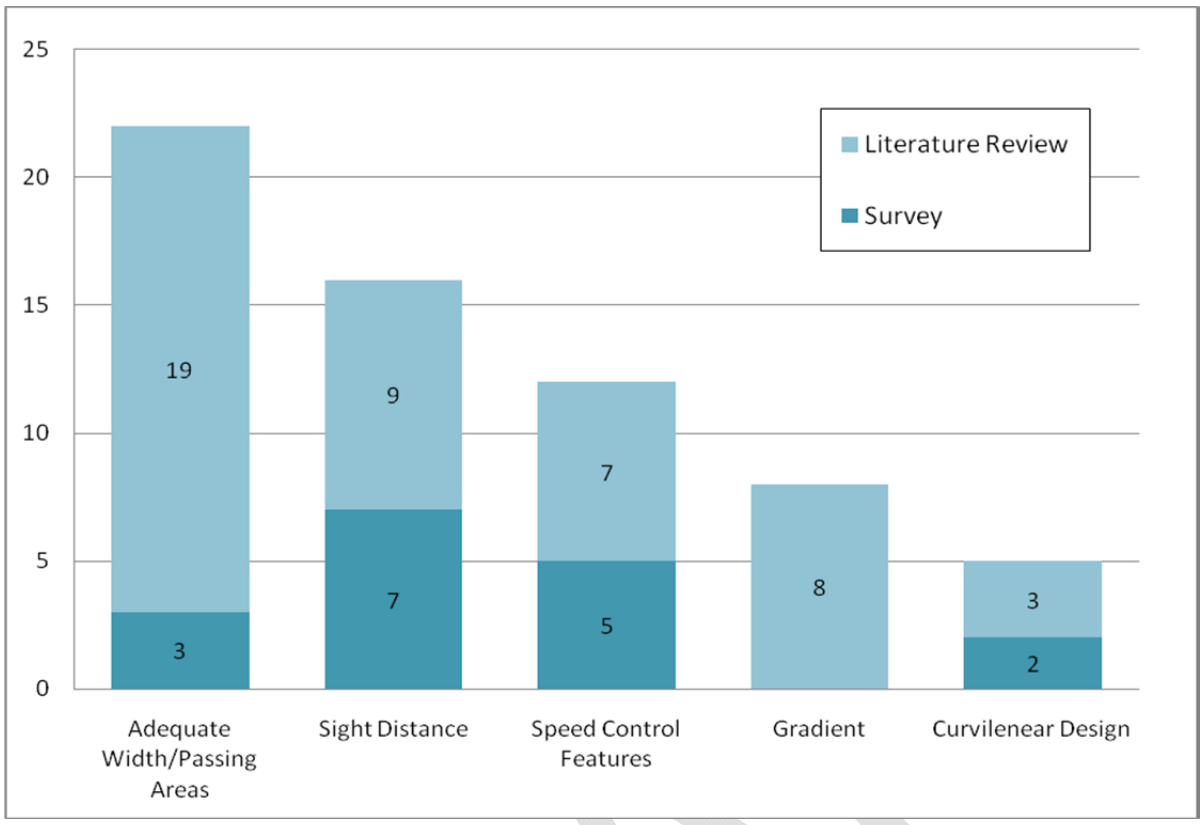


Figure 3-1. Summary of Design Solutions from the Literature Review and Agency Survey

Adequate Width and Passing Space

The width of the trail determines whether users can pass each other easily and safely. It also influences speed; a wide trail may facilitate higher speeds by mountain bikers. Most of the agencies surveyed reported providing sufficient width on trails, without providing specific guidelines.

The *Narrow Natural Surface Trails Study* for the East Bay Regional Parks District (EBPRD 2011) found that, among 15 San Francisco Bay Area parks and open space agencies, the definition of 'narrow natural surface trails' varied from 6 inches to 6 feet wide. Some agencies recommend that trails to accommodate hikers, equestrians, and mountain bikers should be at least 4 feet wide (City of Portland Parks and Recreation, Santa Monica Mountains Area Recreational Trail Coordination Project; Bondurant, Thompson, et. al. 2009) while others recommend a 3-foot minimum (Midpeninsula Regional Open Space District 1993; Minnesota Department of Parks and Recreation, Santa Clara County Parks). The USFS states that hiker- and equestrian-only trails can be as narrow as 1.5 feet wide (USFS 2007; Minnesota Department of Natural Resources 2006). Narrower trail width is part of a suite of speed control elements that are important for safe shared trails (Jellum 2007).

In the literature there is often no clear definition or delineation between the trail tread width and the trail bed widths. These dimensions affect the ability to allow safe passage and provide visible trail space verses the

actual space available (including additional shoulders and refuge areas) to allow users to safely pass each other.

Where trails are too narrow for users to pass each other, clear areas or stable shoulders can act as passing areas to reduce conflicts. A passing area or a stable shoulder can be created from a wide bench that is allowed to overgrow (Santa Clara County Parks; City of Portland Parks and Recreation 2009), and a gentle hillslope condition can also provide a safe shoulder area for passing.

Alternately, where the bench or shoulder cannot continuously provide passing space, passing areas may be provided regularly. The USFS recommends passing spaces for equestrians of 5 feet wide by 10 feet long to allow a single trail animal to pull off the tread (USFS 2007). However, there is little guidance regarding the relationship of topography and frequency of use for placement or variance of placement of passing areas. With the lack of specified direction, it is up to the individual trail manager to implement.

Passing space is closely related to sight distance, i.e., the ability to become aware of other trail users in advance. Passing space is also provided where trails are constructed on relatively gentle side slopes (i.e., 20 percent or less), and dense vegetation is removed or cleared.

Sight Distance

Results from the Literature Review, the Agency Survey, and Program EIR scoping comments frequently noted concerns about poor sight lines and blind corners. Specific standards for sight distance were rarely cited in the research and survey, and tended to vary. One hundred feet is the most-frequently cited. The USFS notes that recommended sight distances for equestrians vary and are most commonly 50 to 100 feet (USFS 2007). A 100-foot average sight distance is recommended on trails by three sources (Santa Clara County Parks Department; Flink, Olka, and Searns 1993; Midpeninsula Regional Open Space District 1993), Several agencies address sight line issues with a policy of regularly thinning overgrowth, especially near curves (Wade County Parks and Recreation; Front Country Trails Multi-Jurisdictional Task Force). Sight distance is strongly related to speed controls; if user speed is reduced, the effectiveness of the sight distance is increased.

Speed Control Features

A number of references and surveys recommended placing or using elements along the trail corridor to create narrowing and turns that encourage users to slow down as they approach. These elements have a wide variety of designs and names including:

- 'Speed chokes' (Wake County Parks, Recreation and Open Space).
- 'Technical trail features' (Lake Tahoe Basin Management Unit).
- Pinch points (CSP Santa Cruz District; IMBA 2007) or stiles (Goldstein 1987).

While agencies commonly use these measures for controlling speed, few design guidelines or manuals provide specific instructions for their use. None of the agencies that discussed speed reduction strategies had specific design guidelines or guidelines that defined minimum width, radii, sight lines, or other factors. Several references and agencies state that, if properly installed and well-maintained, these features can create a lower-conflict and safer trail environment. Several agencies (both those that mentioned using design to reduce speeds and those that did not) cited the IMBA manuals (2004 and 2007), which detail the use of obstacles and choke points.

Goldstein cites a personal interview with a ranger, who recommends that the pinch point be the width of the average set of bicycle cranks, plus 2 or 3 inches (Goldstein 1987). He also recommends avoiding 'stiles,' or offset barriers that users have to negotiate, where wheelchair access is an issue.

In *Managing Mountain Biking*, IMBA recommends adjusting the trail 'flow' with anchors, turns, choke points, and surface textures to control speeds (2007). Sufficient sight distance for users is required to see the obstacle and slow down in advance of the feature, although the document does not recommend specific distances.

Surface Texture

As previously noted, IMBA recommends modifying surface texture to control mountain bikers' speeds on trails. IMBA notes that a variety of textures created with rocks, roots, and other uneven material is a desirable challenge for mountain bikers and requires that they slow down to maneuver through the area. Chiu and Kriwoken (2003) similarly recommend "leaving obstacles and rough surfaces to slow users down." A technique for creating this texture is to place rocks in the trail tread. Sightlines and a gradual transition are keys to using this technique.

In addition, IMBA notes that loose soils are more difficult to brake on, and bicyclists may appear out of control when stopping on a loose surface.

Gradient

Trails can be constructed with a grade change so that users approach a ridge nose (where sightlines are poor) or a trail intersection at a gentle or reduced uphill in either direction, slowing users at potential conflict areas (Santa Clara County Parks; EBRPD 2011).

These techniques can enhance the trail experience for all users by varying sightlines and terrain, and they are a key element of sustainable trails to minimize drainage and erosion (EBPRD 2011; IMBA 2007; Parker 2004). Abrupt changes in grade should be avoided, as should fall line trails, which exacerbate erosion.

Sinuous Layout

Several references state that multi-use trails should be designed with curves to follow the natural topography, reduce users' speeds and to create a more varied and enjoyable trail experience. Sinuous design refers to trails that emphasize curves and minimize straight segments. The turns help slow users and add interest to the trail in terms of varied route and views. This can be created by following the natural contour of the land and gaining or losing elevation by crossing contour line obliquely, by the use of trail anchors and pinch points, as previously discussed, or by weaving the trail between trees and other features. Jefferson County Open Space uses 'chicane-style traffic calming' to reduce speeds on soft-surface trails. And as discussed above (see 'Speed Control Features'), IMBA recommends adjusting the trail 'flow' with anchors, turns, choke points, and surface textures to control speeds (2007).

Turns should not be sudden or too tight for users to safely negotiate, and adequate sight distances must be provided. The USFS notes that horses can comfortably negotiate a minimum turn radius of 5 feet, with 6 to 8 feet preferred (2007).

3.4.3 Other Design Considerations

The five principles outlined above are the primary aspects of design to address trail use conflict that were mentioned in the research. Other considerations were also mentioned that are pertinent because of their overall relationship to trail design.

Additional measures were often mentioned involving separate trails for different user groups, or designated use-intensive trails.

Trail Context: Trail Use Levels, Classifications, and Route Alternatives

Trail context was another commonly mentioned consideration for addressing trail use conflict. Trails that accommodate higher frequency of use and/or a large mix of uses (e.g., many mountain bikers and equestrians, rather than mostly equestrians with a few mountain bikers) may generate more complaints than less-used trails. Other factors that affect the extent of conflict on a trail include whether the trail is a main connection destination, desirable loop or a remote trail, and whether there are many opportunities for each trail user group, or few. The level of use on the trail, its importance as a connection to other trails, and the availability of alternative routes are important considerations for its design.

Several agencies establish design standards for width and passing areas on paved paths based on anticipated use by using a hierarchical classification system. However, few agencies define varying standards for natural surface trails based on anticipated use, user types, or context (Marin Regional Open Space District, EBPRD, City of Portland Parks and Recreation, and Santa Clara County Parks). CSP defines trails as Class I, II, or III based on accessibility, interpretive opportunities, distance to visitor use facilities, parking, dead end, and safety factors. A separate classification system is provided for mountain bike trails, which considers aggressiveness, scenic value, length, environmental conditions, staff-determined use, and other factors.

The CSP *Trail Handbook* (1991) notes that, "Placing trails into class categories allows a manager to objectively assign standards and work priorities to trails which are consistent with their primary function, environmental sensitivity, relationship to developed facilities and visitor use."

Some agencies address these contributing factors by classifying trails within the system as major or minor and define differing design standards based on the classification. The implication is that the context of the trail, including the amount and type of existing and likely use(s), access to trailheads, and availability of alternative trails for users, is an important consideration when determining whether it is appropriate to change a designated use.

3.5 Trail Use Conflict Solutions

Common themes and strategies for addressing trail use conflict emerged from the Literature Review and Agency Survey. These include Management Strategies and Outreach and Coordination Strategies. The research indicates that management, outreach and public information is critical to successfully managing conflict, although there is a wide variation in the approach and reported success of these efforts.

3.5.1 Management Strategies

Trail agencies work directly with users or the public to inform users of the rules, encourage them to follow the rules, and cite them if they break the rules. Direct management strategies rely on regulation of behavior through sanctions or fines while indirect strategies provide information and education to users. Techniques can be subtle or obtrusive, positive, or appealing to a fear of consequence. Management strategies have been classified into the following five groups:

- User information – alternate routes and destinations; regulations, guidelines, advice, safety and courtesy.
- Enforcement – radar, warnings and citations.
- Rules and regulations – right-of-way, warning when overtaking, speed limits.
- Public notification – notification of a project or issue, typically with a point of contact and a venting opportunity such as comment cards or a web form.
- Collecting and tracking data on problems and successes.
- Use restrictions - alternate use days, one-way trails, and designated use-intensive trails.

Figure 3-2 shows the frequency that the Literature Review and Agency Survey noted for each of these management strategies.

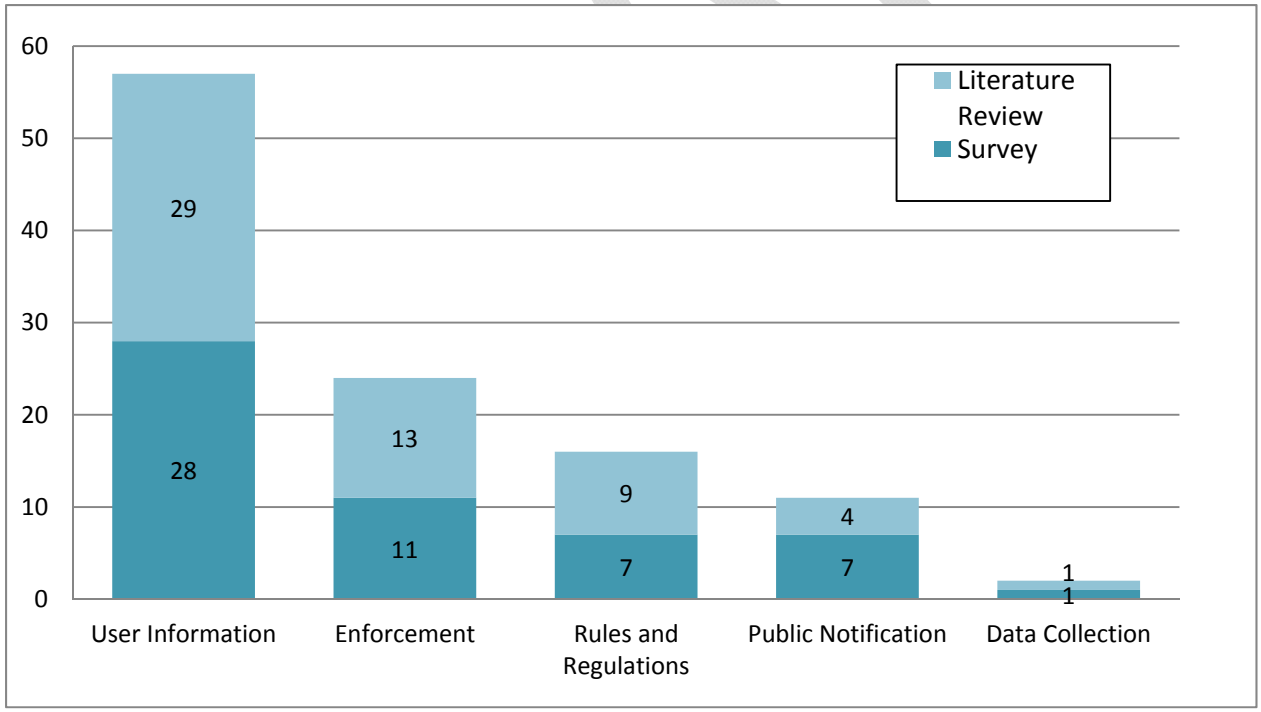


Figure 3-2. Summary of Management Solutions from the Literature Review and Agency Survey

Several of the agencies reported that they had successfully reduced conflicts by prohibiting certain user types. Few of these jurisdictions have a systematic way of determining where certain user types cannot safely share the trail. Unresolvable health, safety, or natural resource issues often rationalize the decision (Oregon Parks and Recreation), although these are seldom defined. These are not discussed in greater detail in the Assessment, as exclusion is not considered a way of accommodating multiple uses on a trail.

User Information

Most jurisdictions post trail courtesy and rules signage such as the yielding triangle, or trailhead instructions for how to behave around horses or mountain bikes. However, there is significant disagreement about how much of an impact posting trail etiquette has on users' behaviors. Several agencies surveyed responded that signs on their own were insufficient (CSP Gold Fields District; Tualatin Hills Parks and Recreation District; Mecklenburg County Park and Recreation; and City of Portland Parks and Recreation) or that only users who are already law-abiding pay attention to signs (Hill County Conservancy).

To increase their impact, signs should cite specific policies with enforceable regulations, or they may recommend yielding or other good behavior. These regulations, as well as why and how the regulations will be enforced and what the applicable penalties are, can be posted at trailheads and included in trail brochures and on maps (Flink and Searns 1993). This information should be distributed via multiple media, including brochures, personal messages, audiovisual programs, newspapers, magazines, guidebooks, trained volunteers, outfitters, commercial guides, wilderness ranger and volunteer role modeling and should be designed for a variety of target audiences (Manning 2003).

Signs are more effective if they appeal to attitudes and beliefs visitors already hold, instead of trying to instill new beliefs. A collaborative effort to improve the trail system in and surrounding the Santa Monica Mountains National Recreation Area concluded that it is essential to post signs at the appropriate location and directed to the group it is communicating information to (Santa Monica Mountains National Recreation Area 1997). To effectively deter noncompliant behavior, managers must address the reason(s) behind the behavior and not just symptoms (Anderson, Lime, and Wang 1998; Manning 2003). Interpretation messages have been found to be as effective as sanction messages and both types are more effective than no message (Duncan and Martin 2002).Rules

Speed limits rules are important tools for managing the potential for trail use conflicts. While posted speed limits on trails tend to be used on paved multi-use trails, several agencies reported using speed limits on natural surface facilities. Speed limits posted by agencies surveyed are consistently 15 mph (Santa Clara County Parks; CSP Gold Fields District; Jefferson County; Sacramento County).

Challenges to the use of speed limits include difficulty of enforcement, lack of enforcement staff, and users' limited knowledge of the speed they are traveling (Bondurant, Thompson, et. al. 2009; IMBA 2007).

Agencies interviewed in the EBRPD *Narrow Natural Surface Trails Study* generally felt that focusing enforcement at parking lots and using radar guns to enforce speed limits were successful strategies (EBPRD 2011). Park agencies often have the power to cite, give warnings, or exclude users who break rules. Agencies surveyed seldom used this authority (CSP Gold Fields District; Oregon Parks and Recreation; Tualatin Hills Parks and Recreation District; Hill County Conservancy). One way of engaging trail users who break rules is to consider sentencing trail offenders to work service on the trail as part (or all) of their penalty (Flink and Searns 1993).

Rules should be enforced consistently to assure users that there is no perception of discrimination among different user groups (Flink and Searns 1993). Flink and Searns also note that signs are more effective if they address attitudes and beliefs visitors already hold and provide information about the rationale for the regulation.

Enforcement

The presence of rangers or other authority figures on the trail can deter undesired activities and encourage users to employ trail etiquette. Ranger patrols can warn or cite users who violate posted regulations and record and respond to comments or complaints from users. Where speed limits are posted, rangers can enforce speeds or issue citations or warnings to rule breakers (Tualatin Hills Parks and Recreation Department; City of Durango; City of Portland Parks and Recreation; Sacramento County). Off-duty police can assist in enforcement (Mecklenburg County; City of Durango).

Volunteers can also assist with patrolling the trail, discussed in the outreach section. Volunteer patrols act as the 'eyes and ears' of a land manager and can enhance visitor experiences, assist land managers, promote trail stewardship, and respond to incidents (IMBA 2007). Volunteer patrols can also model appropriate behavior.

Public Notification

Because user conflict is driven by users' perceptions, it is crucial for agencies to include public discussion and feedback when they are considering new or modified management to reduce conflicts. Public dissatisfaction with the decision-making process can be a barrier to implementing management regulations (Santa Barbara, Town of Pagosa Springs). While it is likely that most agencies alert the public when making planning or policy decisions, and many sources mentioned working with the public more extensively, they did not provide specific details of public notification practices. General strategies regarding coordination with the public are provided in the section on Outreach and Coordination below.

Collecting and Tracking Data

Data about the frequency or rate of incidents promotes user trust in management and reduces perceptions of conflict. This Assessment has found that relatively few incidents on trails occur, particularly when compared to the amount of trail use.

Few of the agencies surveyed collect or retain incident or complaint data, and only three of the Literature Review sources based their analyses of the nature or significance of conflict between users on incident or complaint data. Jefferson County Open Space is currently tracking public responses to alternate day and one-way management strategies they implemented on a trial basis.

To effectively deter noncompliant behavior, managers must address the reason(s) behind the behavior and not just actions (Anderson, Lime, and Wang 1998). To do this, Anderson, Lime, and Wang recommend gathering and evaluating incident and complaint data, use estimates, and user surveys.

Use Restrictions

Use restriction management techniques were frequently mentioned, including alternate use days, one-way trails, and designated use-intensive trails (Flink and Searns 1993).

These strategies are likely to be particularly successful in a setting where the majority of users are local residents who return to the trails, such as state parks that are adjacent to metropolitan areas. However, they may be impractical in a setting where the users come from a wide geographic area and cannot be kept informed in advance of the rules.

Alternating Days

Some park agencies instituted alternating day access, in which mountain bikers are allowed on the trail one day and hikers on another day, or one-way trails on which mountain bikers can only ride in one direction at all time or on certain days (Jefferson County Open Space; Flink and Searns 1993). Jefferson County Open Space staff reports that the alternate use was a successful management response, although other jurisdictions have had difficulty managing and enforcing these regulations. Both hikers and bikers supported an every-other-day exclusion policy in Washington State (Jellum 2007), although an Environmental Assessment in Arizona found the displacement associated with an alternating days strategy to be adverse, if only moderately to negligibly so (National Park Service 2003).

One-Way Trails

Jefferson County Open Space also implements directional trails for one-way travel by mountain bikers. One-way trails are also potentially problematic due to the need to inform users in advance, and the higher risk caused by failure to comply when it is expected by other users, and is rather a "no prospect" alternative.

Single-direction trails can alleviate congestion, provide a more predictable experience, and reduce the number of passes between users. Direction restrictions may be combined with user restrictions (such as on a mountain bike-only trail), applied to only one type of user, or applied at certain times or days (IMBA 2004).

3.5.2 Outreach and Coordination Strategies

Several agencies responded that working with trails groups, holding public meetings and educating the public had the greatest effect on reducing conflicts between users. Outreach and coordination are strategies wherein staff works with user groups, and ideally user groups work with other user groups, to build understanding and cooperative relationships to minimize conflicts. Agencies are increasingly using these types of "bridge building management styles" to engage users and build communities (Chavez 1996b). Chavez notes that, "the increasing use of this [bridge building] strategy often accompanies decreasing budget allocations."

User group outreach and coordination can include the following strategies:

- Education – user-specific printed materials and web postings, and/or an active, focused public relations campaign to educate users about trail use rules and appropriate behavior;
- Meetings with user groups – including general meetings about specific conflict-related issues or objectives.
- Volunteer programs – ongoing trail patrol and/or maintenance assistance, specific projects, outreach and education regarding conflict avoidance, safety, and courtesy;
- User group notification - of a project or issue with a point of contact and venting opportunity such as comment cards or a web form.
- Events –multi-user social, fun, trail construction or maintenance events (e.g. Trail Education Days).

Figure 3-3 shows the frequency of references to outreach and coordination strategies in the Literature Review and the Agency Survey.

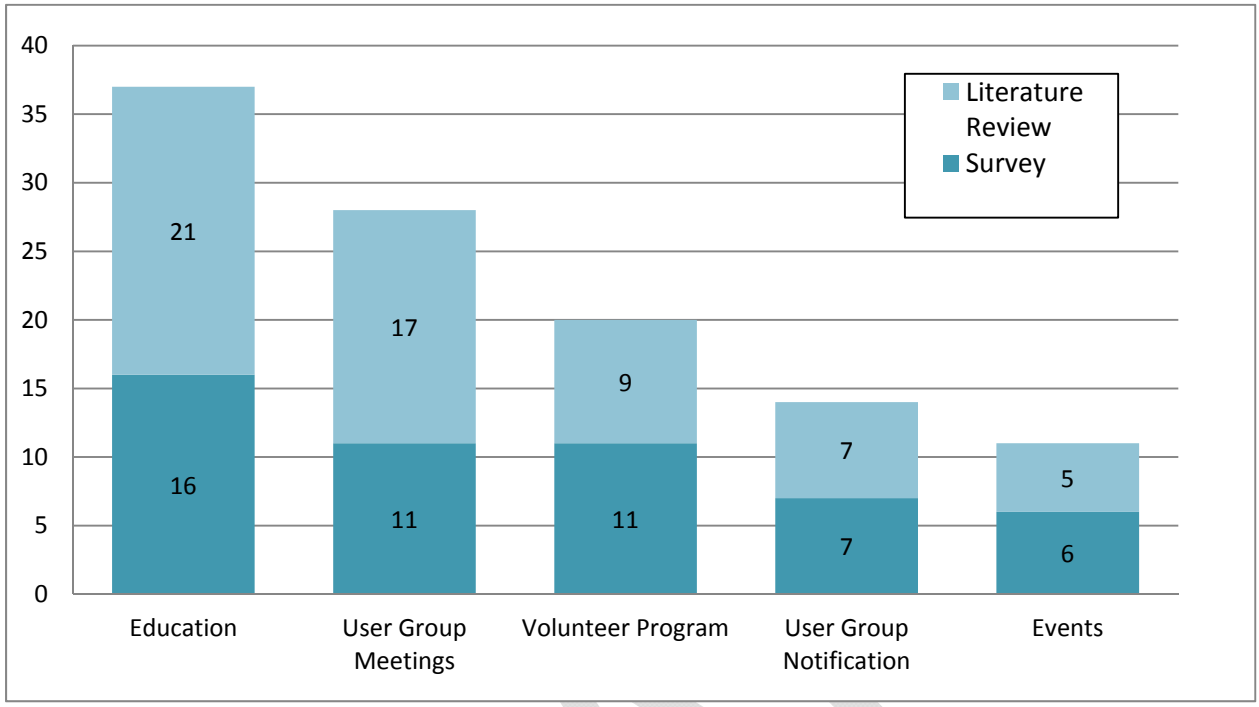


Figure 3-3. Summary of Outreach and Coordination Solutions from the Literature Review and Agency Survey

Education

Many of the agencies who have ranger patrols or who work with volunteers reach out to users through those avenues. Some agencies specifically cited speaking with trail users about sharing the trail as a successful strategy (Lake Norman State Park, Jefferson County Open Space, Turlock Lake, Front Country Trails Multi-Jurisdictional Task Force). Turlock Lake SRA staff noted that education informing users the spirit of trail development and the agency's goal and mission is most effective. In Santa Barbara, staff from the three jurisdictions that are part of Front Country Trails Multi-Jurisdictional Task Force presented best practices of trail sharing, which "helps put the complaints of certain members into perspective."

Conejo Open Space Conservation Agency (COSCA) teaches trail etiquette to local schoolchildren through skits performed at the annual "Trails Education Days." They previously gave out key chains with the yellow etiquette symbol at public events but discontinued that practice due to budget cuts.

Similar to trail user etiquette signs discussed under management strategies, brochures and other outreach methods can be used to inform trail users of expectations and to be aware of other users. Flink and Searns recommend that "if mountain bikers will be using your trail, you should develop an educational campaign on proper trail use for all users" (Flink and Searns 1993).

The California Equestrian Trails and Land Coalition (CETLC) recommends that agencies and user groups educate users about the "startle factor" of horses (CETLC 2005), both for equestrians to be aware of mountain

bikers potentially spooking the horse and for other users about how to act around horses. They recommend holding training clinics for equestrians to teach the horses and riders to meet cyclists in varying situations.

User Group Meetings

Many of the agencies reported working with established user groups to be a successful or necessary strategy. CSP Gold Fields District designates a staff member to attend user group meetings and to work with particular groups on trail work days. Mecklenburg County and the City of Durango recommend maintaining regular communication with different user groups and bringing issues to them as necessary.

Several agencies collaborate with trail groups to plan, construct, and manage trail projects (Vancouver-Clark Parks and Recreation Department [VCPRD], Town of Crested Butte, Mecklenburg County, City of Durango, and Oregon Parks and Recreation).In some cases, agencies reached out to individual trail users independent of user organizations. This type of collaboration can be formalized through a trails committee (COSCA, VCPRD, CSP Gold Fields District) or via open houses. Several agencies hold stakeholder meetings to discuss solutions to user conflicts (Bureau of Reclamation Lower Colorado Region, Henderson), while others hold multi-user trail meetings when developing plans (Oregon State Parks and Recreation and Front Country Trails Multi-Jurisdictional Task Force).Trail Advisory Groups can help identify and solve user conflicts before they become serious problems (IMBA 2007).

EBPRD found that in some cases, collaboration between field staff and the mountain bike and equestrian communities successfully created a shared sense of resource protection and stewardship between staff and bicyclists enthusiasts (EBRPD 2011).

Volunteer Programs

Several agencies work with volunteers to maintain or patrol trails or to encourage and exhibit proper trail etiquette. Volunteer patrols remind users of proper etiquette, model good behavior, and assist trail users with questions (CSP Gold Fields District; Jefferson County Open Space, Tualatin Hills Parks and Recreation District, CRD Parks, City of Henderson). Trail Watch programs can be successful, as they provide a sense of ownership and provide "eyes on the trail" (City of Henderson).

Volunteers can help with several aspects of trail management. They can reach out to other trail users and educate or appeal to them to yield to other users, and they can assist with events such as trail maintenance days and Share the Trail events (Flink and Searns 1993; Bondurant, et. al. 2009).

IMBA highly recommends such programs, stating that volunteer patrols are a "tangible reminder that mountain bikers are aware of their potential effect on other visitors, are committed to regulating themselves, and are willing to give back to the trails in the form of volunteerism" (IMBA 2007). A study conducted on Marin County's popular Mt. Tamalpais found that messages from other mountain bikers were more effective than those coming from a uniformed agency volunteer or a hiker (Hendricks et. al. 2001).

User Group Notification

Similarly to meetings with user groups, notifying groups when beginning a planning effort encourages users to be involved and invested in decisions. While several sources mentioned working with users in planning efforts, they did not provide specific information on the topic, but it is assumed to be a standard practice among agencies who work with user groups.

Trail Events

Agencies can organize or facilitate events that allow different user groups to combine in a controlled, cooperative way, such as trail construction, repair, or maintenance work days; competitions such as triathlons and adventure course events that combine kayaking and/or swimming with trail activities, or events that are simply intended to be fun and social.

Agencies and user groups hold a variety of events on trails, including events with specific 'Share the Trail' messages and more general trail clean-up or maintenance days. Events include "Trail Education Days" for 5th graders (COSCA), trail work days that include all types of users (CSP Gold Fields District; Moore 1994), 'carrot rides' or 'Romp N' Stomp' events in which mountain bikers feed carrots to equestrians' horses (CSP Santa Cruz; Moore 1994; IMBA 2007), bell give-aways (City of San Luis Obispo). Specific staff can be assigned to work with various user groups on trail work days (CSP Gold Fields District).

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Appendix E
Notice of Preparation

Notice of Completion & Environmental Document Transmittal

Mail to: State Clearinghouse, P. O. Box 3044, Sacramento, CA 95812-3044 (916) 445-0613
For Hand Delivery/Street Address: 1400 Tenth Street, Sacramento, CA 95814

SCH # 2011032070

Project Title: Trail Change in Use and Improvement Project Samuel P. Taylor

Lead Agency: California Department of Parks and Recreation | Contact Person: Brad Michalk

Mailing Address: 1 Capital Mall, Suite 410 | Phone: (916) 445-8783

City: Sacramento | Zip: 95814 | County: Sacramento

RECEIVED
APR 18 2011
2:00pm
STATE CLEARING HOUSE

Project Location: County: Marin | City/Nearest Community: Lagunitas

Cross Streets: Sir Francis Drake Blvd. and Devils Gulch Fire Road | Zip Code: 94938

Lat. / Long.: 38° 1′ 46.96″ N/ 122° 44′ 40″ W | Total Acres: 2685

Assessor's Parcel No.: 166-040-06 | Section: n/a | Twp.: n | Range: n/a | Base: n/a

Within 2 Miles: State Hwy #: 1 | Waterways: Lagunitas Creek, Tomales Bay

Airports: n/a | Railways: n/a | Schools: n/a

Document Type:

CEQA: ☒ NOP ☐ Draft EIR ☐ Supplement/Subsequent EIR (Prior SCH No.) 2009058116 ☐ Early Cons ☐ Neg Dec ☐ Mit Neg Dec Other

NEPA: ☐ NOI ☐ EA ☐ Draft EIS ☐ FONSI

Other: ☐ Joint Document ☐ Final Document ☐ Other

Local Action Type:

☐ General Plan Update ☐ General Plan Amendment ☐ General Plan Element ☐ Community Plan
☐ Specific Plan ☐ Master Plan ☐ Planned Unit Development ☐ Site Plan
☐ Rezone ☐ Prezone ☐ Use Permit ☐ Land Division (Subdivision, etc.)
☐ Annexation ☐ Redevelopment ☐ Coastal Permit ☒ Other Change in use

Development Type:

☐ Residential: Units _____ Acres _____
☐ Office: Sq.ft. _____ Acres _____ Employees _____
☐ Commercial: Sq.ft. _____ Acres _____ Employees _____
☐ Industrial: Sq.ft. _____ Acres _____ Employees _____
☐ Educational
☒ Recreational State Park trail

☐ Water Facilities: Type _____ MGD _____
☐ Transportation: Type _____
☐ Mining: Mineral _____
☐ Power: Type _____ MW _____
☐ Waste Treatment: Type _____ MGD _____
☐ Hazardous Waste: Type _____
☐ Other: _____

Project Issues Discussed in Document:

☒ Aesthetic/Visual ☐ Agricultural Land ☒ Air Quality ☒ Archeological/Historical ☒ Biological Resources ☐ Coastal Zone ☒ Drainage/Absorption ☐ Economic/Jobs
☐ Fiscal ☐ Flood Plain/Flooding ☒ Forest Land/Fire Hazard ☒ Geologic/Seismic ☐ Minerals ☒ Noise ☐ Population/Housing Balance ☒ Public Services/Facilities
☒ Recreation/Parks ☐ Schools/Universities ☐ Septic Systems ☐ Sewer Capacity ☒ Soil Erosion/Compaction/Grading ☐ Solid Waste ☒ Toxic/Hazardous ☒ Traffic/Circulation
☒ Vegetation ☒ Water Quality ☐ Water Supply/Groundwater ☒ Wetland/Riparian ☒ Wildlife ☐ Growth Inducing ☒ Land Use ☒ Cumulative Effects
☐ Other _____

Present Land Use/Zoning/General Plan Designation:

Recreational/Public /Open Space

Project Description: *(please use a separate page if necessary)*

Please see attached.

Note: The state Clearinghouse will assign identification numbers for all new projects. If a SCH number already exists for a project (e.g. Notice of Preparation or previous draft document) please fill in.

Reviewing Agencies Checklist

Lead Agencies may recommend State Clearinghouse distribution by marking agencies below with and "**X**".
If you have already sent your document to the agency please denote that with an "**S**".

_____	Air Resources Board	_____	Office of Emergency Services
_____	Boating & Waterways, Department of	_____	Office of Historic Preservation
_____	California Highway Patrol	_____	Office of Public School Construction
X	CalFire	_____	Parks & Recreation
_____	Caltrans District # _____	_____	Pesticide Regulation, Department of
_____	Caltrans Division of Aeronautics	_____	Public Utilities Commission
_____	Caltrans Planning (Headquarters)	X	Regional WQCB # 2
_____	Central Valley Flood Protection Board	_____	Resources Agency
_____	Coachella Valley Mountains Conservancy	_____	Conservation & Development Commission
_____	Coastal Commission	_____	San Gabriel & Lower L.A. Rivers and Mtns Conservancy
_____	Colorado River Board	_____	San Joaquin River Conservancy
_____	Conservation, Department of	_____	Santa Monica Mountains Conservancy
_____	Corrections, Department of	_____	State Lands Commission
_____	Delta Protection Commission	_____	SWRCB: Clean Water Grants
_____	Education, Department of	_____	SWRCB: Water Quality
_____	Energy Commission	_____	SWRCB: Water Rights
X	Fish & Game Region # 3	_____	Tahoe Regional Planning Agency
_____	Food & Agriculture, Department of	_____	Toxic Substances Control, Department of
_____	General Services, Department of	_____	Water Resources, Department of
_____	Health Services, Department of		
_____	Housing & Community Development	_____	Other _____
_____	Integrated Waste Management Board	_____	Other _____
_____	Native American Heritage Commission		

Local Public Review Period (to be filled in by lead agency)

Starting Date April 19, 2011 Ending Date June 1, 2011

Lead Agency (Complete if applicable):

Consulting Firm: _____
Address: _____
City/State/Zip: _____
Contact: _____
Phone: _____

Applicant: Department of Parks and Recreation
Address: One Capital Mall, Suite 410
City/State/Zip: Sacramento, CA 95418
Phone: (916) 445-8783

Signature of Lead Agency Representative: _____ **Date:** 04/18/2011

Authority cited: Section 21083, Public Resources Code. Reference: Section 21161, Public Resources Code.

NOTICE OF PREPARATION

Samuel P. Taylor State Park, Trail Change in Use and Improvement Project

Project Description

Class I trails include accessible, equestrian, bike, interpretive, and hiking uses. Generally, these trails contain spur trails, gravel, turnpikes and puncheons or other drainage structures for resource protection and visitor safety.

Bill's Trail is currently used by equestrians and hikers only. More recently mountain biking interest groups have petitioned to open Bill's Trail to biking as well. DPR proposes to change the 'use' of Bill's Trail to allow mountain biking in addition to hiking and horseback riding making the trail consistent with the Department's policy to construct multiple use trails. In order to convert the trail to Class I that would allow mountain biking, DPR must "catch up" with the deferred maintenance that has narrowed the trail, reduced drainage function, allowed exotic species to flourish and reduced user safety.

Bill's Trail has a constructed width of 48", the standard for multi-use trails in State Parks and continues nearly four (4) miles between the trail head in Devil's Gulch and the junction with the Barnabe Fire Road at 1,160-foot elevation. DPR staff completed a Trail Use Change Survey and prepared a trail log (Appendix D) identifying needed repairs, soil types, and features. The following summarizes the proposed work:

Trail Work

- Brush the trail from top of cut bank to top of fill slope to maintain constructed trail width and original brushed line of sight;
- Improve trail out-sloping and remove any developing outer edge (berm) trail tread to original design width averaging 48" (from top hinge of fillslope to bottom hinge of cut bank or back slope) to maintain drainage. Trail bench work will be limited to maximum of 6" in depth; ground disturbance will stay within the existing profile (top of cut bank to bottom of fill slope);
- Remove debris collecting on the inside hinge to maintain trail width and remove loose debris;

Bridge Repair/Drainage

- Replace wood-armored ephemeral stream crossings with rock armored crossings, as needed;
- Install armored rock crossings at all ephemeral drainages and micro drainages to harden the trail tread. Specific work to include:
- Manually excavate up to 18" of trail tread (in the ephemeral drainage) and backfill with large, flat-topped rock to provide a stable crossing;
- Place rock in the ephemeral stream channel gradient;
- Repair bridges as needed; no work would occur lower than existing bridge components within the bed and/or stream channel. Specific work to include:
- Excavate bridge approaches (and abutments as necessary) outward to first substantive vegetation and backfill with gravel;
- Install gravel surfacing to provide a stable tread surface at bridge approaches;
- Resource Management:
- Remove non-native eucalyptus trees identified by a DPR-approved Environmental Scientist to improve the stand management and encourage naturally occurring tree species; Where eucalyptus would be removed at least 75 square feet of basal area per acre (any tree species) would be retained on the slope;
- Logs hoisted to the trail would be suspended to minimize ground impacts;

User Safety

- Construct pinch points with two, 18" diameter or larger logs (from existing downed trees on site or imported as needed) protruding onto the trail from each side creating the need to travel an 'S' path to negotiate the path through the logs. Pinch points will be placed in approximately 100 locations along Bill's Trail to reduce bicycle speed and increase the 'line of sight" at curves, improving user safety. Where appropriate, rocks could be used in place of eucalyptus logs;
- Install signage to inform user groups how to have a safe and fun trail experience without conflict;
- Repair, replace or install split rail fencing along trail as needed for safety, resource protection, and shortcut prevention;

Gravesite Fire Road

- Improve and rehabilitate limited sections of road as needed per California State Park guidelines (Brian R. Merrill, 2003)
- Ditchouts and rolling dips will be armored with aggregate at and near the outlet to reduce erosion. Aggregate would transitionally increase in size toward the outlet end.

No work will be performed on Barnabe Fire Road and is not a part of this project.

Appendix F

Special Status Wildlife and Plant Species

	frog		non-breeding habitat	non-breeding habitat
REPTILES				
Actinemys mamorata marmorata	northwestern pond turtle	SSC	potentially suitable habitat	no suitable habitat
Caretta caretta	loggerhead turtle	FT	no suitable habitat	no suitable habitat
Chelonia mydas (incl. agassizi)	green turtle	FT	no suitable habitat	no suitable habitat
Dermochelys coriacea	leatherback turtle	FE	no suitable habitat	no suitable habitat
Lepidochelys olivacea	olive (=Pacific) Ridley sea turtle	FT	no suitable habitat	no suitable habitat
BIRDS				
Accipiter cooperi	Cooper's hawk		potentially suitable habitat	potentially suitable habitat
Accipiter gentilis	northern goshawk	SSC	no suitable habitat	no suitable habitat
Accipiter striatus	sharp-shinned hawk		potentially suitable habitat	potentially suitable habitat
Ardea alba	great egret		no suitable habitat	no suitable habitat
Ardea herodias	great blue heron		potentially suitable habitat	no suitable habitat
Athene cunicularia	burrowing owl	SSC	no suitable habitat	no suitable habitat
Brachyramphus marmoratus	marbled murrelet	FT, SE	no suitable habitat	no suitable habitat
Chaetura vauxi	Vaux's swift	SSC	potentially suitable habitat	potentially suitable habitat
Charadrius alexandrinus nivosus	western snowy plover	FT, SSC	no suitable habitat	no suitable habitat
Circus cyaneus	northern harrier	SSC	potentially suitable habitat	potentially suitable habitat
Coccyzus americanus	western yellow-billed cuckoo	SE	no suitable habitat	no suitable habitat
Cypseloides niger	black swift	SSC	potentially suitable habitat	no suitable habitat
Dendroica petechia brewsteri	yellow warbler	SSC	potentially suitable habitat	potentially suitable habitat
Diomedea albatrus	short-tailed albatross	FE	no suitable habitat	no suitable habitat
Elanus leucurus	white-tailed kite	FP	potentially suitable habitat	potentially suitable habitat
Falco columbarius	merlin		potentially suitable habitat	potentially suitable habitat
Falco peregrinus anatum	Peregrine falcon	SE	potentially suitable habitat	potentially suitable habitat
Geothlypis trichas sinuosa	saltmarsh common yellowthroat	SSC	no suitable habitat	no suitable habitat
Laterallus jamaicensis coturniculus	California black rail	ST	no suitable habitat	no suitable habitat
Melospiza melodia samuelis	San Pablo song sparrow	SSC	no suitable habitat	no suitable habitat
Pandion haliaetus	osprey		occurs in park	potentially suitable habitat
Pelecanus occidentalis californicus	California brown pelican	FE, SE	no suitable habitat	no suitable habitat
Phoebastris albatrus	short-tailed albatross	FE, SSC	potentially suitable habitat	no suitable habitat
Progne subis	purple martin	SSC	potentially suitable habitat	potentially suitable habitat
Rallus longirostris	California clapper rail	FE, SE	no suitable habitat	no suitable habitat

obsoletus				
Sternula antillarum (=Sterna*, =albifrons) *browni	California least tern	FE, SE	no suitable habitat	no suitable habitat
Strix occidentalis caurina	northern spotted owl	FT, SSC	occurs in park	potentially suitable habitat
MAMMALS				
Antrozous pallidus	pallid bat	SSC	potentially suitable habitat	potentially suitable habitat
Aplodontia rufa phaea	Point Reyes mountain beaver	SSC	potentially suitable habitat	potentially suitable habitat
Arborimus pomo	Sonoma tree vole	SSC	outside of known range	outside of known range
Arctocephalus townsendi	Guadalupe fur seal	FT, ST	no suitable habitat	no suitable habitat
Balaenoptera borealis	sei whale	FE	no suitable habitat	no suitable habitat
Balaenoptera musculus	blue whale	FE	no suitable habitat	no suitable habitat
Balaenoptera physalus	finback (=fin) whale	FE	no suitable habitat	no suitable habitat
Corynorhinus townsendii	Townsend's big-eared bat	SSC	no suitable habitat	no suitable habitat
Eubalaena (=Balaena) glacialis	right whale	FE	no suitable habitat	no suitable habitat
Eumetopias jubatus	Steller (=northern) sea-lion	FT	no suitable habitat	no suitable habitat
Lasionycteris noctivagans	silver-haired bat		potentially suitable habitat	potentially suitable habitat
Lasiurus blossevillii	western red bat	SSC	potentially suitable habitat	potentially suitable habitat
Lasiurus cinereus	hoary bat		no suitable habitat	no suitable habitat
Megaptera novaengliae	humpback whale	FE	no suitable habitat	no suitable habitat
Myotis evotis	long-eared myotis		potentially suitable habitat	potentially suitable habitat
Myotis yumanensis	Yuma myotis		potentially suitable habitat	potentially suitable habitat
***Physeter catedon* (= *macrocephalus*)**	sperm whale	FE	no suitable habitat	no suitable habitat
Reithrodontomys raviventris	salt marsh harvest mouse	FE, SE	no suitable habitat	no suitable habitat
Taxidea taxus	American badger	SSC	potentially suitable habitat	potentially suitable habitat

SE State Endangered
ST State Threatened
SCE State Candidate for Listing
SSC CDFG California Species of Special Concern
FP CDFG Fully Protected Species
FE Federally Endangered
FT Federally Threatened
PE Proposed Federally Endangered
C Federal Candidate
DPS Distinct Population Segment
ESU Evolutionarily Significant Unit

TABLE 4.3.2: Special Status Plant Species Evaluated for Project

Table 1: List of Special Status Plant Species Known to Occur or Potentially Occur Within the Project Area					
Scientific Names	**Common Names**	**Habitat Requirements**	**CNPS[1]**	**Status**	**Suitable Habitat Present in Project Area/ Species Observed or Documented within Project Area**
Abronia umbellata ssp. *breviflora*	pink sand verbena	coastal dunes	List 1B.1		No/No
Allium peninsulare var. *franciscanum*	Franciscan onion	cismontane woodland, valley and foothill grassland/clay, volcanic, often serpentinite	List 1B.2		No/No
Alopecurus aequalis var. *sonomensis*	Sonoma alopecurus	marshes and swamps (freshwater), riparian scrub	List 1B.1	FE	No/No
Amorpha californica var. *napensis*	Napa false indigo	broadleafed upland forest (openings), chaparral, cismontane woodland	List 1B.2		Yes/No MAYBE
Amsinckia lunaris	bent-flowered fiddleneck	coastal bluff scrub, cismontane woodland, valley and foothill grassland	List 1B.2		Yes/No MAYBE
Arctostaphylos hookeri ssp. *montana*	Mt. Tamalpais manzanita	Chaparral, valley and foothill grassland/serpentinite, rocky	List 1B.3		No/No
Arctostaphylos virgata	Marin manzanita	broadleafed upland forest, closed-cone coniferous forest, chaparral, North Coast coniferous forest/sandstone or granitic substrate	List 1B.2		No/No
Astragalus pycnostachyus var. *pycnostachyus*	coastal marsh milk-vetch	coastal dunes (mesic), coastal scrub, marshes and swamps (coastal salt, streamsides)	List 1B.2		No/No
Astragalus tener var. *tener*	alkali milk-vetch	playas, valley and foothill grassland (adobe clay), vernal pools/alkaline	List 1B.2		No/No
Boschniakia hookeri	small groundcone	North Coast coniferous forest	List 2.3		No/No
California macrophylla	round-leaved filaree	cismontane woodland, valley and foothill grassland/clay	List 1B.1		Yes/No UNLIKELY
Calochortus tiburonensis	Tiburon mariposa lily	valley and foothill grassland	List 1B.1	FT, ST	No/No

		(serpentinite)			
Campanula californica	swamp harebell	bogs and fens, closed-cone coniferous forest, coastal prairie, meadows and seeps, marshes and swamps, (freshwater), North Coast coniferous forest/mesic	List 1B.2		No/No
Carex lyngbyei	Lyngbye's sedge	marshes and swamps (brackish or freshwater)	List 2.2		No/No
Castilleja affinis ssp. *neglecta*	Tiburon paintbrush	valley and foothill grassland (serpentinite)	List 1B.2	FE, ST	No/No
Castilleja ambigua ssp. *humboldtiensis*	Humboldt Bay owl's-clover	marshes and swamps, (coastal salt)	List 1B.2		No/No
Ceanothus gloriosus var. *porrectus*	Mt. Vision ceanothus	closed-cone coniferous forest, coastal prairie, coastal scrub, valley and foothill grassland	List 1B.3		Yes/No NOT FOUND
Ceanothus masonii	Mason's ceanothus	chaparral (rocky, serpentinite)	List 1B.2	SR	No/No
Chorizanthe cuspidata var. *cuspidata*	San Francisco Bay spineflower	coastal bluff scrub, coastal dunes, coastal prairie, coastal scrub/sandy	List 1B.2		No/No
Chorizanthe robusta var. *robusta*	robust spineflower	chaparral(maritime), cismontane woodland (openings), coastal dunes, coastal scrub/sandy or gravelly	List 1B.1	FE	No/No
Chorizanthe valida	Sonoma spineflower	coastal prairie, (sandy)	List 1B.1	FE, SE	No/No
Cicuta maculata var. *bolanderi*	Bolander's water-hemlock	marshes and swamps, coastal, fresh or brackish water	List 2.1		No/No
Cirsium andrewsii	Franciscan thistle	broadleafed upland forest, coastal bluff scrub, coastal prairie, coastal scrub/mesic, sometimes serpentinite	List 1B.2		Yes/No
Cirsium hydrophilum var. *vaseyi*	Mt. Tamalpais thistle	broadleafed upland forest, chaparral, meadows and seeps/serpentinite seeps	List 1B.2		No/No
Collinsia corymbosa	round-headed Chinese-houses	coastal dunes	List 1B.2		No/No
Cordylanthus maritimus ssp. *palustris*	Point Reyes bird's-beak	marshes and swamps (coastal salt)	List 1B.2		No/No
Cordylanthus mollis ssp. *mollis*	soft bird's-beak	marshes and swamps (coastal salt)	List 1B.2	FE, SR	No/No
Delphinium bakeri	Baker's larkspur	broadleafed upland forest, coastal scrub, valley and foothill grassland/decomposed shale,	List 1B.1	FE, SE	No/No

		often mesic			
Delphinium luteum	golden larkspur	chaparral, coastal prairie, coastal scrub/rocky	List 1B.1	FE, SR	Yes/No
Dirca occidentalis	western leatherwood	broadleafed upland forest, closed-cone coniferous forest, chaparral, cismontane woodland, North Coast coniferous forest, riparian forest, riparian woodland/mesic	List 1B.2		Yes/No NOT FOUND
Entosthodon kochii	Koch's cord moss	cismontane woodland (soil)	List 1B.3		No/No
Erigeron biolettii	streamside daisy	broadleafed upland forest, cismontane woodland, North Coast coniferous forest/rocky, mesic	List 3		Yes/No
Eriogonum luteolum var. *caninum*	Tiburon buckwheat	chaparral, cismontane woodland, coastal prairie, valley and foothill grassland/serpentinite, sandy to gravelly	List 1B.2		No/No
Fissidens pauperculus	minute pocket moss	North Coast coniferous forest, (damp coastal soil)	List 1B.2		Yes/No
Fritillaria lanceolata var. *tristulis*	Marin checker lily	coastal bluff scrub, coastal prairie, coastal scrub	List 1B.1		Yes/No
Fritillaria liliacea	fragrant fritillary	cismontane woodland, coastal prairie, coastal scrub, valley and foothill grassland/often serpentinite	List 1B.2		Yes/No
Gilia capitata ssp. *chamissonis*	blue coast gilia	coastal dunes, coastal scrub	List 1B.1		No/No
Gilia capitata ssp. *tomentosa*	woolly-headed gilia	coastal bluff scrub(rocky, outcrops)	List 1B.1		No/No
Grindelia hirsutula var. *maritima*	San Francisco gumplant	coastal bluff scrub, coastal scrub, valley and foothill grassland/sandy or serpentinite	List 1B.2		No/No
Helianthella castanea	Diablo helianthella	broadleafed upland forest, chaparral, cismontane woodland, coastal scrub, riparian woodland, valley and foothill grassland	List 1B.2		No/No
Hemizonia congesta ssp. *congesta*	pale yellow hayfield tarplant	valley and foothill grassland/sometimes roadsides	List 1B.2		Yes/No
Hesperevax sparsiflora var. *brevifolia*	short-leaved evax	coastal bluff scrub (sandy), coastal dunes	List 1B.2		No/No

Hesperolinon congestum	Marin western flax	chaparral, valley and foothill grassland/serpentinite	List 1B.1		No/No
Holocarpha macradenia	Santa Cruz tarplant	coastal prairie, coastal scrub, valley and foothill grassland/often clay, sandy			No/No
Horkelia marinensis	Point Reyes horkelia	coastal dunes, coastal prairie, coastal scrub/sandy	List 1B.2		No/No
Horkelia tenuiloba	thin-lobed horkelia	broadleafed upland forest, chaparral, valley and foothill grassland/mesic openings, sandy	List 1B.2		No/No
Lasthenia californica ssp. *macrantha*	perennial goldfields	coastal bluff scrub, coastal dunes, coastal scrub	List 1B.2		No/No
Lasthenia conjugens	Contra Costa goldfields	cismontane woodland, playas, valley and foothill grassland, vernal pools/mesic	List 1B.1	FE	No/No
Layia carnosa	beach layia	coastal dunes, coastal scrub (sandy	List 1B.1	FE, SE	No/No
Leptosiphon croceus	coast yellow leptosiphon	coastal bluff scrub, coastal prairie	List 1B.1		No/No
Lessingia hololeuca	woolly-headed lessingia	broadleafed upland forest, coastal scrub, lower montane coniferous forest, valley and foothill grassland/clay, serpentinite	List 3		No/No
Lessingia micradenia var. *micradenia*	Tamalpais lessingia	Chaparral, valley and foothill grassland/usually serpentinite, often roadsides	List 1B.2		No/No
Lilaeopsis masonii	Mason's lilaeopsis	marshes and swamps (brackish or freshwater), riparian scrub	List 1B.1	SR	No/No
Lilium maritimum	coast lily	broadleafed upland forest, closed-cone coniferous forest, coastal prairie, coastal scrub, marshes and swamps (freshwater), North Coast coniferous forest/sometimes roadside	List 1B.1		Yes/No NOT FOUND
Lupinus tidestromii	Tidestrom's lupine	coastal dunes	List 1B.1	FE, SE	No/No
Micropus amphibolus	Mt. Diablo cottonweed	broadleafed upland forest, chaparral, cismontane woodland, valley and foothill grassland/rocky	List 3.2		No/No
Microseris paludosa	marsh microseris	closed-cone coniferous forest, cismontane woodland, coastal scrub, valley and foothill	List 1B.2		Yes/No

		grassland			
Mielichhoferia elongata	elongate copper moss	cismontane woodland (metamorphic, rock, usually vernally mesic)	List 2.2		No/No
Navarretia leucocephala ssp. *bakeri*	Baker's navarretia	cismontane woodland, lower montane coniferous forest, meadows and seeps, valley and foothill grassland, vernal pools/mesic	List 1B.1		No/No
Navarretia rosulata	Marin County navarretia	closed-cone coniferous forest, chaparral/serpentinite, rocky	List 1B.2		No/No
Pentachaeta bellidiflora	white-rayed pentachaeta	cismontane woodland, valley and foothill grassland (often serpentinite)	List 1B.1	FE, SE	Yes/No
Phacelia insularis var. *continentis*	North Coast phacelia	coastal bluff scrub, coastal dunes/sandy, sometimes rocky	List 1B.2		No/No
Plagiobothrys glaber	hairless popcorn-flower	meadows and seeps, (alkaline), marshes and swamps(coastal salt)	List 1A		No/No
Plagiobothrys mollis var. *vestitus*	Petaluma popcorn-flower	marshes and swamps, (coastal salt), valley and foothill grassland (mesic	List 1A		No/No
Pleuropogon hooverianus	North Coast semaphore grass	broadleafed upland forest, meadows and seeps, North Coast coniferous forest/open areas, mesic	List 1B.1	ST	Yes/No NOT FOUND
Polygonum marinense	Marin knotweed	marshes and swamps (coastal salt or brackish)	List 3.1		No/No
Quercus parvula var. *tamalpaisensis*	Tamalpais oak	lower montane coniferous forest	List 1B.3		Yes/No NOT FOUND
Sidalcea calycosa ssp. *rhizomata*	Point Reyes checkerbloom	marshes and swamps (freshwater, near coast)	List 1B.2		No/No
Sidalcea hickmanii ssp. *viridis*	Marin checkerbloom	chaparral (serpentinite)	List 1B.3		No/No
Stebbinsoseris decipiens	Santa Cruz microseris	broadleafed upland forest, closed-cone coniferous forest, chaparral, coastal prairie, coastal scrub, valley and foothill grassland/open areas, sometimes serpentinite	List 1B.2		Yes/No
Streptanthus batrachopus	Tamalpais jewel-flower	closed-cone coniferous forest,	List 1B.3		No/No

		chaparral/serpentinite			
Streptanthus glandulosus ssp. *pulchellus*	Mount Tamalpais bristly jewel-flower	chaparral, valley and foothill grassland/serpentinite	List 1B.2		No/No
Streptanthus niger	Tiburon jewel-flower	valley and foothill grassland (serpentinite)	List 1B.1	FE, SE	No/No
Trifolium amoenum	two-fork clover	coastal bluff scrub, valley and foothill grassland (sometimes serpentinite)	List 1B.1	FE	Yes/No
Triphysaria floribunda	San Francisco owl's-clover	coastal prairie, coastal scrub, valley and foothill grassland/usually serpentinite	List 1B.2		No/No
Triquetrella californica	coastal triquetrella	coastal bluff scrub, coastal scrub/soil	List 1B.2		No/No

[1]California Native Plant Society (CNPS) Lists: List 1A = presumed extinct in California; List 1B = rare or endangered in California and elsewhere; List 2 = rare or endangered in California, more common elsewhere; List 3 = need more information; List 4 = plants of limited distribution. New threat code extensions are: .1 = seriously endangered in California; .2 = fairly endangered in California; and .3 not very endangered in California.

SE State Endangered
ST State Threatened
SR State Rare
CSC California Special Concern
FE Federally Endangered
FT Federally Threatened
FSC Federal Special Concern

Appendix G

Patrick Vaughn – Trail Observations

Trail: Bill's Trail Date: 7-Feb-11

Segment: All Park Unit: Samuel P. Taylor State Park

			Size/Qty					
Meters	**Action**	**Feature**	**L**	**H**	**W**	**Units**	**Comment**	**Total**
0							Bill's Trail trailhead	
30			100				low level fluvial terraces are on the left bank of Devil's Gulch; these terraces can store fine sediment that might result from trail reconstruction or recreational activities upslope	100
515							volunteer trail descends from the trail along the inner gorge slope	
530							a series of 2 to 4 foot diameter at breast height Douglas fir trees have swept trunks a short distance upslope from the trailcut; ground in the vicinity has some broken appearance – the features at 515 to 530 are within the possible envelope of a sediment source identified by PCI (1988)	
700							A small eucalyptus grove, with trunk diameters in excess of 3 feet, is proposed for removal;	
860							Bridge 3 crosses an incised channel; the immediate channel banks are notably more incised than other drainages;	
1240			125				probable old landslide crosses the trail and terminates in the drainage bearing Stairstep Falls	125
2510							cutbank slump in damp area, most debris cleared from trail (no sediment delivery potential)	
3255							damage noted due to volunteer trail across switchback (no to low sediment delivery potential if addressed)	
3820							damage noted due to volunteer trail across switchback (no to low sediment delivery potential if addressed)	
6005							junction with Barnabe Fire Road, scattered minor waterbars	
6455							very minor water bars and minor rilling in the road as the road traverses generally hard bedrock, generally at a 15% to 20% road grade to a ridgecrest 7290	
6815							very minor water bars and minor rilling in the road as the road traverses generally hard bedrock, generally at a 15% to 20% road grade to a ridgecrest 7290	
6925							very minor water bars and minor rilling in the road as the road traverses generally hard bedrock, generally at a 15% to 20% road grade to a ridgecrest 7290	

7130			85				A segment of the road has a 25% grade that is partially confined by a throughcut (more extensive rilling and a failed waterbar were noted on this road segment)	85
7290			385				recent grading had developed rolling dips and/or large water bar/associated ditch outs at 7350, 7410, 7450, 7495, 7540, 7580, 7615 and 7575. Rilling from freshly graded fill was noted that extended into vulnerable moderately sloping prairie soils at some of the ditch outs.	385
7675							Gravesite Fire Road/Barnabe Fire Road Junction	
7725							Recent grading had improved or created additional large water bar/associated ditch outs	
7805							Recent grading had improved or created additional large water bar/associated ditch outs	
7845							Recent grading had improved or created additional large water bar/associated ditch outs	
7905							Ditchout	
7950							Ditchout; fine sediment from the ditchouts appeared to have access to the channel	
7990							Ditchout; fine sediment from the ditchouts appeared to have access to the channel	
8005							channel approaches are armored with 5 to10 centimeter angular rock about 5 meters from the channel margins. 0.5 to 1 meter diameter boulders armor a knickpoint on the lower edge of the crossing	
8005			25				North from the crossing the road was very wet; straw had been placed to inhibit flow from a bend in the road to the channel. Grading nearby appeared to reflect an attempt to develop a route around the wet road segment north from the channel.	25
8055							An unarmored seeping drainage crossed the road and flowed to Deadman's Creek.	
8385			90				the road descends at about 20% grade toward the mainstem of Devil's Gulch. A series of fiber water bars at about 15 meter spacings broke up flow in this road segment and directed finer-grained earth material toward a curl in the fiber at the outlet that acted as an effective stilling basin for the sediment.	90
8475			35				Road narrows to a trail and is within 0.5 to 1 meter of the top of the banks of the mainstem.	35

Appendix H

Karl Knapp Primary Qualifications

Karl Knapp
20151 State Route 89
Markleeville, CA 96120
DUNNS: 616206640

Instructor Qualifications

- A minimum of 5 years experience teaching one or more components of the Trails Management Process to beginner and advanced students.

  Total Experience 26 years

  Instructor - Trails Management – Plans, Projects and People - 7 years

  From 2001, I have been involved with the original interagency Trails Management – Plans, Projects and People (BLM course # 8300-17) class. I have been an instructor in Trail Management Process, Crew Management, Trail Design and Layout, Construction and Maintenance, Crew Leadership, Operations and Safety. Additionally I was on the Design Team, which set up the initial curriculum. I have been involved in field site set up at each of the locations in the western and eastern United States.

  Instructor California State Parks Trail Management and Construction Trails Training Experience – 14 years

  From 1994, I have been involved with the curriculum designed and instruction of California State Parks, William Penn Mott Training Center, Basic, Intermediate and Advanced Trails Training. Primary instructor for 6 college accredited trails training classes. Curriculum covered is Trail Management Process, Trail Planning, Design, Layout, Trail Construction and Maintenance, Trail Structure Design, Construction and Maintenance, ADA Trail Design, Construction and Maintenance, Road to Trail Conversion and Trail Rigging Applications.

  Single Subject Instructor, College of the Redwoods Trails Training – 8 years

  1984 – 1993 I designed and instructed junior college accredited trails training. One hundred twenty hour course including Trail Management Process, Trail Planning, Design, Layout, Trail Construction and Maintenance, Trail Structure Design, Construction and Maintenance.

- A minimum of 10 years field experience working hands-on with one or more components of the Trail Management Process.

  Total experience 32 years

  My career with California State Parks includes 32 years of Trails Management Process hands-on experience. In my career I have been a Trail Crew Leader,

Roads and Trails Supervisor, Maintenance Chief with a 1 million dollar yearly trail program that included up to 4 trail crews and 3 contract service corps crews under my management. I also was the State Parks Trails Manager for 273 State Parks in California.

My experience includes all the aspects of Trails Management, including Planning, Design, Layout, Construction, Maintenance, Monitoring, Crew Leadership, Interpretation, Operations and Safety.

Technical Evaluation Criteria Experience

- Expertise in subject-matter trail management and outdoor recreation

  Total Experience 26 years

  Combined experience with trail management training, I have been a presenter at State and National trail conferences, Presenter at Professional Trail Builders Conference and associated workshops since 1994; assisted United States Forest Service, National Park Service, Bureau of Land Management and Fish and Wildlife Service on trail training; National Center of Accessibility presenter, Private trail consultant with contracts with National Park Service, Bureau of Land Management, Fish and Wildlife Service and numerous private entities such as Pacific Gas and Electric Company.

  Instructor at William Penn Mott Training Center for Park Management, Trails Management and Facilities Maintenance Management for California State Parks.

- Experience working as part of a group of instructors for a variety of federal, state and local agencies.

  Total Experience 26 years

  I have lead and developed training teams for the California Trails Conference, National Conferences, Mott Training Center, BLM National Training Center, National Conservation Training Center, National Park Service and Local agencies that included developing instructional teams consisting of National Park, National Forest, Bureau of Land Management, US Fish and Wildlife Service and numerous local and State employees. These teams have been developed around specific trainings and repeated trainings with standard curriculums.

- Past performance on contracts of projects that are similar in size and scope to this requirement.

  Total Experience 8 years

  I have held primary and employee professional services contracts for the National Park Service, Bureau of Land Management, United States Fish and Wildlife Service and Pacific Gas and Electric Company for trail training, trail design and layout.

These contracts have involved training participants up to 36 participants and been for duration of one week.

- Ability to communicate and work with a variety of groups indoors and outdoor settings.

  Total experience 28 years

  As 32 year employee of California State Parks I have been training and presenting on all issues of park management, park planning and maintenance management operations. I have been a participant in the department's leadership development team, recognized as a department training instructor and represented the department at public meetings. I have been a certified single subject college accredited instructor for Trails Management 1982 – 1994. This included indoor and outdoor instructional settings with college accredited trails management, forestry management, and skilled trades college classes.

  I have been teaching trail construction and maintenance workshops since 1980 to governmental agencies and volunteer groups. This includes the groups such as Coast Walk, IMBA, Tahoe Rim Trail, California State Trails Conference, National Trails Conferences and State and Federal Agencies.

  Since 1990 I have been instructing and training for the William Penn Mott Training Center for California State Parks, BLM National Training Center, California Conservation Corps Training Academy, and National Center for Accessibility and the National Park Service Denver Service Center.

  Since 2000 I have been, as a private consultant, been providing paid training for the National Park Service (Big Bend, Grand Canyon and Denali National Parks), the Bureau of Land Management (National Training Center and Las Vegas Field Office) and the Professional Trails Builders Association.

All of this training has been class room based and outdoor hands-on field work for agency personnel, service corps, volunteers and trail contractors.

1) <u>Resume</u>

Karl C Knapp

Education:

College of San Mateo – 1975
College of the Redwoods – 1976 – 1977 Associate Arts Degree
Humboldt State University – 1978 – 1980 Geography Major, Geology Minor, and Degree not obtained.

Licenses/Certificates:

California Class A Drivers License
California Grade II Water Treatment License

Employment

Private Consultant: 2000 – Present

Professional services contracts for the National Park Service, Bureau of Land Management, United States Fish and Wildlife Service and Pacific Gas and Electric Company for trail training, trail design and layout. These contracts have involved training participants up to 36 participants and been for a duration of one week

Staff Park and Recreation Specialist – 1/1/2007 – Present

Coordinates program level management of the Department Road and Trail Program. This includes the Special Grants, FEMA, Deferred Maintenance, Minor and Major Capital Outlay and other Specially Funded Projects. Supports the implementation of the Departments Trails Policy which includes the development of Road and Trail Management plans for field units. It assists field units in the development of special grants and outside funding sources.

District Maintenance Chief - 7/1/1994 – 12/31/2006

Coordinates the Maintenance Program for 22 parks in six counties of the Sierra District which include museums, house museums, natural preserves, state reserves, state historic parks, state parks and state recreation areas. In addition the District is home to 8 National Historic Districts and 1 National Natural Landmark. The District Maintenance Chief has the consulting responsibility for District wide

maintenance program for 3 Sector operations and directly manages the District wide programs which include; Road and Trail Operations, Equipment Maintenance, Historic Building Stabilization and Restoration and Water and Sewage Systems.

1975 -1994
Held various field positions including seasonal employee, State Park Ranger, State Park Maintenance Worker, Conservation Crew Supervisor and Park Maintenance Supervisor.

Appendix I

Stakeholders Mailing Distribution List

Marin State Parks Association
P.O. Box 223
Inverness, CA. 94937

International Mountain Bicycling Association
2750 Land Park Drive
Sacramento, CA 95818

Barbara Salzman,
48 Ardmore Road
Larkspur, CA 94939

Mount Tamalpais Interpretive Association
P.O. Box 3318
San Rafael, CA 94912-3318

Tamalpais Conservation Club
P.O. Box 2272
Mill Valley, CA 94942

Bay Area Trails Preservation Council
P.O. Box 153
Corte Madera, CA 94976

Golden Gate National Recreation Area
Building 201, Fort Mason
San Francisco, CA 94123

Sierra Club (National Headquarters)
85 Second Street, 2nd Floor
San Francisco, CA 94105

Bicycle Trails Council of Marin
P.O. Box 494
Fairfax, CA 94978

Point Reyes National Seashore
1 Bear Valley Road
Point Reyes Station, CA 94956

Sierra Club (Marin Chapter)
C/O Gordon Bennett
40 Sunnyside Dr.
Inverness, CA 94937

Bay Area Ridge Trail Council
1007 General Kennedy Avenue,
Suite 3
San Francisco, CA 94129-1405

Marin County Parks and Open Space District
3501 Civic Center Drive Room #415
San Rafael, CA 94903

Marin Conservation League
1623A Fifth Avenue
San Rafael, CA 94901

SPAWN (Salmon Protection and Watershed Network)
PO Box 370
Forest Knolls, CA 94933

Marin Municipal Water District
220 Nellen Avenue
Corte Madera, CA 94925

California State Parks Foundation
800 College Avenue
Kentfield, CA 94914

Trout Unlimited
North Bay Chapter
P.O. Box 6016
San Rafael, CA 94903

Bay Area Barns and Trails
PO Box 2435
Mill Valley, CA 94942-2435

Bay Area Barns and Trails
PO Box 2435
Mill Valley, CA 94942-2435

National Audubon Society
P.O. Box 599
Mill Valley, CA 94942

Marin Horse Council
171 Bel Marin Keys Blvd.
Novato, CA 94949

Audubon Canyon Ranch
4900 Highway One
Stinson Beach, CA 94970

Access 4 Bikes
P.O. Box 150772
San Rafael, CA. 94915-0772

Appendix J

Mitigation Monitoring and Reporting Plan

Project Requirement/Mitigation Measure	Timing	Responsible for Implementing Project Requirements and Mitigations	Responsible for Insuring Implementation	Required for task to be complete	Date Completed	Status/ Comments
AESTHETICS						
Mitigation Measure AES 1: Active Management and Maintenance Qualified DPR staff will annually (or as needed) inspect the trail during the first three years following reopening to users and will prepare a report regarding CEQA-related issues (does not include user conflict), available for public review at District Headquarters. The report will include, but not be limited to the following for each issue: ▪ Trail Sustainability (additional users, impacts and trail degradation); ▪ Impact identification, including source of impact if possible; ▪ Recommendations to remedy impact; ▪ Implementation schedule; ▪ Follow up on remedy effectiveness in 3 months. If after, re-inspection: park staff determines the remedy to be effective, no further action is required on that issue; if DPR staff is unable to remedy an identified issue, a Superintendent's Order could be used to immediately reduce user type, seasonally or permanently close the trail, and/or any other action deemed necessary to protect the impacted resource or user groups. DPR staff will utilize a Trail Use Survey to determine which user groups can maintain trail sustainability.	Annually for first three years following construction completion.	Qualified DPR Staff	DPR Sector Superintendent	DPR will conduct annual inspections (or more frequently as needed) and prepare a report on CEQA—related issues. If needed to address a resource or trail condition issue, a remediation plan shall be prepared identifying the nature of the improvement. A follow-up inspection will be required to determine the effectiveness of the remedy.		
AIR QUALITY						
Standard Project Requirement AIR 1: Ozone-Related Emissions ▪ DPR and its contractor(s) will maintain all construction equipment in good mechanical condition, according to manufacturer's specifications. Construction equipment exhaust emissions will not exceed Bay Area Air Quality Management District (BAAQMD) Regulation IV – Rule 400 – Visible Emissions limitations (Cal EPA 2007b). ▪ All off-road and portable diesel-powered equipment, including but not limited to bulldozers, graders, cranes, loaders, scrapers, backhoes, generator sets, compressors, auxiliary power units, will be fueled with California Air Resources Control Board (CARB)-certified motor vehicle diesel fuel. ▪ Idling time for all diesel-powered equipment will be limited to five minutes, except as necessary to maintain a continuous workflow or for safety considerations. ▪ The use of diesel construction equipment meeting the CARB's 1996 or newer certification standard for off-road heavy-duty diesel engines will be maximized to the extent feasible.	Duration of Project Construction	Project Proponent and/or Contractor	DPR Construction Manager and/or Inspector	DPR Construction Manager will visually confirm in the field that actions specified in AIR 1 have been implemented during program actions. Update MMRP with status and date completed.		

▪ Electric and/or gasoline-powered equipment or equipment using alternative fuels, such as compressed natural gas (CNG), liquefied natural gas (LNG), propane, or biodiesel, will be substituted for diesel-powered equipment, when available.						
Standard Project Requirement AIR 2: Particulate Matter Fugitive Dust Emissions ▪ Ground-disturbing activities will be suspended when sustained winds exceed 25 mph, instantaneous gusts exceed 35 mph, or dust from construction might obscure driver visibility on public roads. ▪ Disturbed areas of the site will be watered as necessary depending on the conditions, using water trucks and/or sprinkler systems, to prevent airborne dust from leaving the site. If available, reclaimed (non-potable) water will be used. ▪ All dirt stockpiles would be covered (tarped) or watered daily, as necessary to prevent dispersion of windblown dust. ▪ All trucks hauling dirt, sand, soil, or other loose materials would be covered or would maintain at least two feet of freeboard (minimum vertical distance between top of load and top of trailer), in accordance with California Vehicle Code Section 23114. ▪ All disturbed areas in inactive portions of the site would be covered, seeded, and/or watered until a suitable cover is established or construction activities are resumed. Non-toxic soil stabilizers could be used in accordance with county, Regional Water Quality Control Board (RWQCB), (CRWQCB) and California Air Resources Board (CARB) standards. ▪ Permanent dust control measures would be implemented as soon as possible following completion of any soil disturbing activities. ▪ The name and telephone number of such persons will be posted on site throughout construction and provided to the BAAQMD. The phone number of the Bay Area Air Quality Management District will also be visible to ensure compliance with Rule 402 (Nuisance) (CEPA 2007b). Project requirements would also be implemented during holidays, weekend periods, or times when work is temporarily suspended, as necessary to control site conditions generating fugitive dust.	Duration of Project Construction	Project Proponent and/or Contractor		DPR Construction Manager will visually confirm in the field that actions specified in AIR 1 have been implemented during program actions. Update MMRP with status and date completed.		
BIOLOGICAL RESOURCES						
Specific Project Requirement BIO 1.1: Marin blind harvestman ▪ A DPR-approved biological monitor will survey for species of harvestman prior to any project activities that require the moving of any medium to large sized rocks. If any	Prior to Construction and duration of Project	DPR-Qualified Biologist	DPR Environmental Scientist	The DPR Environmental Scientist, or qualified staff, will append a memo to the MMRP documenting compliance with BIO 1.1. The report shall		

specimens are located then the DPR-approved biological monitor will relocate the species to a suitable location outside of the project area.				include an explanation of any incidents, actions taken, success of the avoidance and protection measures, and the general condition of the occurrences.		
Specific Project Requirement BIO 1.2: Marin Hesperian ▪ If any snail species is found on the project site while work activities are being conducted, work in the vicinity of the snail will be delayed until the species is relocated to a suitable location outside of the project area by a DPR-approved biological monitor.	Prior to Construction and duration of Project	DPR-Qualified Biologist	DPR Environmental Scientist	The DPR Environmental Scientist, or qualified staff, will append a memo to the MMRP documenting compliance with BIO 1.2. The report shall include an explanation of any incidents, actions taken, success of the avoidance and protection measures, and the general condition of the occurrences.		
Standard Project Requirement BIO1.3: California red-legged frog ▪ Construction personnel will be instructed by a USFWS or DPR-approved biological monitor in the life history of the California red-legged frog and its habitat, and instruction in the appropriate protocol to follow in the event that a California red-legged frog is found onsite. ▪ A USFWS -approved biological monitor will be onsite during all activities within 500 feet of perennial streams to ensure there are no impacts to individual California red-legged frogs that might potentially move through the project area on dispersal. ▪ Immediately prior to the start of work each morning a USFWS or DPR-approved biological monitor will conduct a visual inspection of the construction zone, prior to the start of work. ▪ A U.S. Fish and Wildlife Service approved biologist shall survey the work site two weeks before the onset of activities. If California red-legged frogs (CRLF) or tadpoles are found, the approved biologist shall capture and relocate them away from the project construction site and to the nearest suitable aquatic habitat. If egg masses are found, they shall not be removed and no work shall occur until the tadpoles metamorphose and then relocate the metamorphs. Only the approved biologist shall be able to capture, handle and relocate the animals, and he/she shall be given ample time to move the animals prior to commencement of work.	Prior to construction and Duration of Project	DPR/USFWS-Qualified Biologist	DPR Environmental Scientist	The DPR Environmental Scientist, or qualified staff, will append a memo to the MMRP documenting compliance with BIO 1.3. If another person is assigned POC< the DPR Environmental Scientist will coordinate with the POC in preparing compliance documentation that will be utilized in the Environmental Scientist's memo appended to the MMRP. The report shall include an explanation of any incidents, actions taken, success of the avoidance and protection measures, and the general condition of the occurrences.		
Standard Project Requirement BIO 1.4: Northern Spotted Owl ▪ If possible, all noise-generating construction activities will occur outside of the breeding season for the northern spotted owl (September 1 – January 31). The specific	Prior to construction and Duration of Project	DPR-Qualified Biologist	DPR Environmental Scientist	The DPR Environmental Scientist, or qualified staff, will append a memo to the MMRP documenting compliance with BIO 1.4. The report shall		

dates of the breeding season could be adjusted through consultations with USFWS based on the characteristics of the local population ▪ If construction activities must be scheduled during the breeding season, protocol-level surveys by a USFWS or DPR-approved biologist will be conducted prior to construction to locate nests, or survey data from local biologists monitoring owl populations in the area may be used if appropriate. ▪ If a breeding pair and/or nest are located during surveys, then no construction activities resulting in noise disturbance above ambient levels may occur within ¼ mile of the nest during the breeding season. ▪				include an explanation of any incidents, actions taken, success of the avoidance and protection measures, and the general condition of the occurrences.		
Standard Project Requirement BIO 1.5: Nesting Raptors and Migratory Birds ▪ If possible, all noise-generating construction activities will occur outside the raptor and migratory bird breeding season (September 16 – January 31). ▪ If construction-related activities must be scheduled during the breeding season, then focused surveys for nesting migratory bird and raptor species will be conducted by a DPR-approved biologist before construction activities occur in these months to identify active nests. ▪ Surveys for active raptor nests will be conducted within a 500-foot radius of the project area 10 days prior to the beginning of construction at each work site. If nesting raptors are found, no construction will occur within a 500-foot radius of the nest until the young have fledged and the young will no longer be impacted by project activities (as determined by a DPR-approved biologist) and there is no evidence of a second attempt at nesting. ▪ Surveys for active migratory bird nests will be conducted within a 100-foot radius of the project area 10 days prior to the beginning of construction at each work site. If active nests are located, then no construction activities will occur within a 100-foot radius of the nest tree until the young have fledged and the young will no longer be impacted by project activities (as determined by a DPR-approved biologist).	Prior to construction and Duration of Project	DPR-Qualified Biologist	DPR Environmental Scientist	The DPR Environmental Scientist, or qualified staff, will append a memo to the MMRP documenting compliance with BIO 1.5. The report shall include an explanation of any incidents, actions taken, success of the avoidance and protection measures, and the general condition of the occurrences.		
Standard Project Requirement BIO 1.6: Sensitive Bat Species ▪ If possible, all noise-generating construction activities will occur outside the bat maternity season (September 1 – January 31). ▪ If project activities must be conducted during the bat maternity season, prior to work, a DPR-approved bat specialist will conduct surveys of suitable bat roosting	Prior to construction and Duration of Project	DPR-Qualified Biologist	DPR Environmental Scientist	The DPR Environmental Scientist, or qualified staff, will append a memo to the MMRP documenting compliance with BIO 1.6. The report shall include an explanation of any incidents, actions taken, success of the avoidance and protection measures, and the		

habitat within 100-feet of the work area. If potential bat roosts are found, night emergence surveys shall be conducted to determine presence or absence of bats. If bats are absent then work shall begin within 1-2 days. If bats are present, work shall not comment within 100-feet of the roost and shall be postponed until the end of the maternity season.				general condition of the occurrences.		
Standard Project Requirement BIO 2.1: Sensitive Natural Plant Communities • Within the root health zone (5 times dbh) of any native tree with a dbh of 12 inches or greater, no roots with a diameter of 2 inches or greater will be severed by project activities, unless authorized in advance by a DPR-approved biologist.	Duration of Project Construction	DPR-Qualified Biologist	DPR Environmental Scientist	The DPR Environmental Scientist, or qualified staff, will append a memo to the MMRP documenting compliance with BIO 2.1. The report shall include an explanation of any incidents, actions taken, success of the avoidance and protection measures, and the general condition of the occurrences.		
Standard Project Requirement BIO 2.2: Sudden Oak Death ▪ All project activities that could spread Phytophthora ramorum to new locations will be subject to Best Management Practices (BMPs) developed by the California Oak Mortality Task Force and available online at http://www.suddenoakdeath.org/html/best_management_practices.html. ▪ Sudden Oak Death BMPs include but are not limited to: ▪ Inform personnel that they are working in a Sudden Oak Death (SOD)-infested area, unauthorized movement of plant material is prohibited, and the intent of these prevention measures is to prevent spread of SOD. ▪ Before leaving project area, remove or wash-off accumulations of plant debris, soil, and mud from shoes, boots, vehicles, and heavy equipment, etc. Clean with denatured alcohol or similar materials.	Duration of Project Construction	Project Proponent and/or Contractor	DPR Environmental Scientist	The DPR Environmental Scientist, or qualified staff, will append a memo to the MMRP documenting compliance with BIO 2.2. The report shall include an explanation of any incidents, actions taken, success of the avoidance and protection measures, and the general condition of the occurrences.		
Standard Project Requirement BIO 3: Wetlands, Riparian Zones, and Waters of the U.S. ▪ A wetlands and waters of the United States delineation report will be prepared and submitted to the appropriate office of the U. S. Army Corps of Engineers (USACE) for jurisdictional determination under Section 404 of the Clean Water Act. ▪ If required by the USACE a 404 permit under the Nationwide Permit Program will be obtained for this project and all conditions imposed by the permitting authority will be implemented.	Duration of Project Construction	DPR-Qualified Biologist	DPR Environmental Scientist	The DPR Environmental Scientist, or qualified staff, will append a memo to the MMRP documenting compliance with BIO 3. The report shall include an explanation of any incidents, actions taken, success of the avoidance and protection measures, and the general condition of the occurrences.		
CULTURAL RESOURCES						
Standard Project Requirement CULT 2: Previously Undocumented Resources	Duration of Project	DPR-Qualified Cultural Resource	DPR Construction Manager, DPR-	Prior to Program Actions, DPR Cultural Resource Specialists		

• In the event that previously undocumented/unflagged cultural resources (including but not limited to dark soil containing shellfish, bone, flaked stone, groundstone, or deposits of historic material) are encountered during project activities, all work in that location will be temporarily halted and diverted to another location, until DPR's State Representative is contacted; a DPR-qualified cultural resource specialist will record and evaluate the find and work with the Project Proponent and/or Construction Contractor to implement avoidance, preservation, or recovery measures, as appropriate, prior to any work resuming at that specific location.	Construction	Specialist	Qualified Cultural Resources Specialist, and/or Inspector	will ensure that DPR-Qualified Cultural Resource Specialist develops an adequate Construction Monitoring and Unanticipated Discovery Response Plan (CMUDRP) during Program Actions., SPR Cultural Resource Specialist will work with the Project Proponents and/or contractor to comply with CULT 2prior to, and during, Program Actions, as applicable. DPR Cultural Resource Specialist will append a memo to the MMRP with a copy of the CMIDRP, the results of the monitoring. The reports will include an explanation of any incidents, actions taken, success of the avoidance and protection measures, and the general condition of the occurrences.		
Standard Project Requirement CULT 3: Human Remains ▪ In the event that human remains are discovered during Program Actions, all work at that location will be temporarily halted and diverted to another location. Any human remains and/or funerary objects will be left in place. The Project Proponent and/or Construction Contractor will immediately contact the DPR State's Representative who will then contact the DPR Sector Superintendent. The DPR Sector Superintendent (or authorized representative) will notify the County Coroner, in accordance with §7050.5 of the California Health and Safety Code, and the Native American Heritage Commission (NAHC) will be notified within 24 hours of the discovery if the Coroner determines that the remains are Native American. The NAHC will designate the "Most Likely Descendent" (MLD) of the deceased Native American. The MLD will recommend an appropriate disposition of the remains. If a Native American monitor is at the Park at the time of the discovery, and that person has been designated the MLD by the NAHC, the monitor will make the recommendation of the appropriate disposition. Work will not resume in the area of the find until proper disposition is complete (PRC §5097.98). No human remains or funerary objects will be cleaned, photographed, analyzed, or removed from the site prior to determination. If it is determined the find indicates a sacred or religious site, the site will be avoided to the maximum extent practicable.	Duration of Project Construction	Project Proponent and/or Contractor	DPR Sector Superintendent, County Coroner and Native American Heritage Commission	DPR Cultural Resources Specialist will work with the Project Proponents and/or Contractor to comply with CULT 3 during project actions, as applicable. DPR Cultural Specialist will append a memo to the MMRP if any human remains are discovered during Program Actions. The reports will include an explanation of any incidents, actions taken, success of the avoidance and protection measures, and the general condition of the occurrences.		
GEOLOGY AND SOILS						

Standard Project Requirement GEO 1 Best Management Practices ▪ Bare earth materials at water course crossings will receive 80% to 85% mulch cover using on site native materials. Where the ground is not mulched, native vegetation will be planted. ▪ Brushing of trail cuts will minimize the damage to root systems to help retain vegetation on the cut-slope. Upon removal of temporary sidecast and initial sediment flush controls lighter materials will be collected from brushing and placed (as feasible considering the steepness of the slope) as an additional filter at the trail edge where it is at the top of the banks of the main stem of Devil's Gulch or within the buffer limits for sidecast control (0 to 30, 130 to 375 and 8475 to 8510). Aggregate will also be placed along the same trail section. ▪ Rock will be obtained from a Surface Mining and Reclamation Act (SMARA) approved quarry and contain no more fines than necessary to act as a binder. Aggregate will be placed at crossings to inhibit rutting per the guidelines of the governing regulatory agency. ▪ Where eucalyptus will be removed at least 75 square feet of basal area per acre (any tree species) will be retained on the slope. Logs hoisted to the trail will be suspended to minimize ground impacts. ▪ To inhibit moisture capture logs used for pinch points will be no longer than necessary. Logs will not be placed within the buffers for watercourses outlined for sidecast and initial sediment control. ▪ Ditchouts and rolling dips along the fire roads will be armored with aggregate at and near the outlet (if founded in fill) to inhibit erosion. Alternatively, the fill will be removed from the outlet of the drainage structure.	Duration of Project Construction	Project Proponent and/or Contractor	DPR Construction Manager and/or Inspector	DPR Construction Manager will append the BMPs to the MMRP prior to the start of Program Actions. DPR Construction Manager will visually confirm in the field that Project Proponents and/or Contractor are in compliance with measures specified in GEO 1 and any additional measures specified in the BMPs. DPR Construction manager will update the MMRP with status and include an explanation of any incidents, actions taken, success of the avoidance and protection measures, and the general condition of the occurrences.		
Specific Project Requirement GEO 2 Seismic Event ▪ In the event of a large earthquake on a nearby fault or significant rainfall event, the trail will be inspected to determine if cracks or cutbank failures could contribute sediment to nearby watercourses – if such material is identified it will either be stabilized or relocated outside the buffer zone identified for sidecast materials.	Duration of Project	DPR-qualified Personnel	DPR Construction Manager and/or Inspector	After a large earthquake event as defined in GEO 2, DPR-qualified personnel will append a memo to MMRP with the results of the inspection and closure recommendations, as applicable.		
Specific Project Requirement GEO 3 Revegetation Plan ▪ This project will result in temporary impacts to native vegetation resulting from proposed trail improvements. These impacts will be addressed by implementing a revegetation plan that will restore native plant habitat in affected areas. The objective is to establish self-sustaining native vegetation. This plan will include the following elements: ▪ Identification of areas requiring revegetation;	Following completion of earth moving activities	Project Proponent and/or Contractor	DPR Construction Manager and/or Inspector	DPR Construction Manager will append the Revegetation Plan to the MMRP prior to the start of Program Actions. DPR Construction Manager will visually confirm in the field that Project Proponents and/or Contractor are in compliance with measures specified in GEO		

▪ Identification of native species that are appropriate and site specific; ▪ Requirement that plantings be grown from native seed/cuttings collected in the park or plantings from local nurseries that are derived from genetic stock that was obtained from areas surrounding the park; and ▪ A monitoring and maintenance program that includes follow-up plantings as necessary to achieve success criteria as outlined in this plan.				3 and any additional measures specified in the Revegetation Plan. DPR Construction manager will update the MMRP with status and include an explanation of any incidents, actions taken, success of the avoidance and protection measures, and the general condition of the occurrences.		
HAZARDS AND HAZARDOUS MATERIALS						
Standard Project Requirement HAZ 1 a-c Spill Prevention ▪ Prior to the start of construction, the Contractor will inspect all equipment for leaks and inspect equipment daily thereafter until it is removed from the project site. ▪ Prior to the start of construction, the contractor will prepare a Stormwater Pollution Prevention Plan (SWPPP) that will include Best Management Practices (BMPs) for materials management, fueling, repair, and maintenance of vehicles and equipment, and spill prevention and control. The Contractor will maintain a spill kit on-site throughout the life of the project. The SWPPP will include a map that delineates construction staging areas and where refueling, lubrication, and maintenance of equipment may occur. Areas designated for refueling, lubrication, and maintenance of equipment will be at least 50 feet away from all streams. In the event of any spill or release of any chemical in any physical form at the project site or within the boundaries of the Park during construction, the contractor will immediately notify the appropriate DPR staff (e.g., project manager, supervisor, or State Representative). ▪ Equipment will be cleaned and repaired (other than emergency repairs) outside the park boundaries. All contaminated water, sludge, spill residue, or other hazardous compounds will be disposed of outside park boundaries, at a lawfully permitted or authorized destination.	Prior to actions and for the Duration of the Project	Project Proponent and/or Contractor	DPR Construction Manager and/or Inspector	DPR Construction Manager will append the SWPPPs and BMPs to the MMRP prior to the start of Program Actions. DPR Construction Manager will visually confirm in the field that Project Proponents and/or Contractor are in compliance with measures specified in HAZ 1 and any additional measures specified in the SWPPPs and BMPs. DPR Construction manager will update the MMRP with status and include an explanation of any incidents, actions taken, success of the avoidance and protection measures, and the general condition of the occurrences.		
Standard Project Requirement HAZ 2 Health and Safety ▪ DPR will include, in any contract documents or in internal work plan documents, health and safety specifications on how to manage any potential hazardous incidents. The specifications will include methods for safe handling, collection, and proper disposal of any contaminated soil and refuse uncovered during the excavation and grading procedures. The specifications will discuss the proper personal protection during construction, the use of an exclusion zone if necessary to prevent exposure to the public, and the proper disposal procedures for any hazardous substances encountered.	Prior to actions and for the Duration of the Project	Project Proponent and/or Contractor	DPR Construction Manager and/or Inspector	DPR Construction manager will visually confirm in the field that Project Actions have been suspended in the event of any hazardous incidents. DPR Construction manager will update the MMRP with status and include an explanation of any incidents, actions taken, success of the avoidance and protection measures, and the general condition of the		

				occurrences.		
Project Specific Requirement HAZ 7 a-c – Fire Safety ▪ A fire safety plan will be developed by the contractor and/or DPR and approved by DPR prior to the start of construction. This plan will include the emergency reporting procedures of the Marin County Fire Department. ▪ Spark arrestors or turbo-charging (which eliminates sparks in exhaust) and fire extinguishers will be required for all heavy equipment. ▪ Construction crews will be required to park vehicles away from flammable material, such as dry grass or brush. At the end of each workday, heavy equipment will be parked over asphalt or concrete to reduce the chance of fire. The contractor will also be required to have fire extinguishers on site.	Prior to actions and for the Duration of the Project	Project Proponent and/or Contractor	DPR Construction Manager and/or Inspector	DPR Construction Manager will append the Fire Safety Plan to the MMRP prior to the start of Program Actions. DPR Construction Manager will visually confirm in the field that Project Proponents and/or Contractor are in compliance with measures specified in HAZ 7 and any additional measures specified in the Fire Safety Plan. DPR Construction manager will update the MMRP with status and include an explanation of any incidents, actions taken, success of the avoidance and protection measures, and the general condition of the occurrences.		
HYDROLOGY AND WATER QUALITY						
Standard Project Requirement HYDRO 1: Erosion, Sediment Control and Pollution Prevention ▪ A Stormwater Pollution Prevention Plan (SWPPP) will be required that includes temporary construction and permanent post-construction Best Management Practices (BMPs) to control soil and surface water runoff, including, but not limited to, use of silt fences, weed-free straw bales, weed-free fiber rolls, and/or sediment detention basins to prevent soil loss and siltation. SWPPP will also include measures to allow construction to occur outside the normal construction season. Long term revegetation BMPs will be guided by the Project Revegetation Plan (see Bio 10, Revegetation Plan). ▪ The SWPPP will also include spill prevention, vehicle and equipment management, and materials management BMPs to prevent releases of non-sediment pollutants, such as vehicle and equipment fluids and any construction-related materials. ▪ Flow will not be concentrated toward the slump near 7010 and if other drainage modifications are made will not divert flow from one micro-watershed to another for slopes below the Barnabe and Gravesite fire roads. Berms will be removed from the road edge where consistent with vehicular safety and micro-drainage integrity can be respected. ▪ Trail construction activities will occur between April 15 and October 15 each year to avoid the period of highest rainfall, streamflows and erosion potential. During periods of inclement weather, operations will be shut down until	Prior to actions and for the Duration of the Project	Project Proponent and/or Contractor	DPR Construction Manager and/or Inspector	DPR Construction Manager will append the SWPPPs and BMPs to the MMRP prior to the start of Program Actions. DPR Construction Manager will visually confirm in the field that Project Proponents and/or Contractor are in compliance with measures specified in HYDRO 1 and any additional measures specified in the SWPPPs and BMPs. DPR Construction manager will update the MMRP with status and include an explanation of any incidents, actions taken, success of the avoidance and protection measures, and the general condition of the occurrences.		

streamflows are sufficiently low and soil/channel conditions are sufficiently dry and stable to allow construction to continue without the threat of substantial soil compaction, erosion, sedimentation, or offsite sediment transport. Construction activities can occur outside of this window outside of riparian areas if winter season operating conditions permit and with appropriate BMPs in place. ▪ No excavation work will occur on slopes greater than 10% during periods of heavy rains (at least ½ inch of precipitation in a 24-hour period) or when soils are saturated. ▪ Work will be directed and/or inspected periodically on-site by the Project Manager or other qualified personnel to assure soil compaction and finish grading meet job specifications. ▪ Plant duff and organic soil will be removed from graded areas and stored. After grading is complete the stored material will be spread over disturbed areas intended for revegetation as identified in the Project Revegetation Plan.						
Specific Project Requirement HYDRO 2: Initial Trail Closure ▪ The trail and road will be closed during construction and remain closed for one year following completion of construction to allow the trail to season. Gates will be constructed at each of the 7 bridge crossings that will remain locked until the trail is open for use.	Duration of construction and one year following completion of construction	Project Proponent and/or Contractor	DPR	The DPR Construction Manager will post signs in appropriate locations notifying patrons of the trail closure. A Trail Notice Closure shall also be posted on the park website. Upon completion of the project, the gates on the trail shall be maintained in a closed and locked position for one year.		
Specific Project Requirement HYDRO 3: Seasonal Trail Closures ▪ Bills' Trail will be closed seasonally during periods of saturated and softened soils to maximize sustainability, minimize trail maintenance, and support resource protection by limiting potential rain generated sediment transport. Closure will be ensured by locked gates at each of the 7 bridge crossings including the bridge over Devil's Gulch.	Seasonally and as conditions require	DPR personnel	DPR	Park staff shall the gates on the trail shall maintained gates in a closed and locked position seasonally or as trail conditions warrant.		
NOISE						
Specific Project Requirement NOISE 1: Construction Noise Reduction Plan ▪ Prior to the start of construction, DPR and/or its Contractor will prepare a Construction Noise Reduction Plan that will address noise control methods during construction activities at the project site and in staging and storage areas. Measures identified in the Construction Noise Reduction Plan will be implemented by DPR and/or its Contractor throughout the construction period and monitored by DPR. The plan will be approved in advance by Marin County Community Development Agency and	Duration of Project Construction	Project Proponent and/or Contractor	DPR Construction Manager and/or Inspector	DPR Construction Manager will append the Noise Reduction plan to the MMRP prior to the start of Program Actions. DPR Construction Manager will visually confirm in the field that Project Proponents and/or Contractor are in compliance with measures specified in NOISE 1 and any additional measures specified in the Noise		

conform to noise reduction requirements of the County.				Reduction Plan. DPR Construction manager will update the MMRP with status and include an explanation of any incidents, actions taken, success of the avoidance and protection measures, and the general condition of the occurrences..		
Standard Project Requirement NOISE 2: Noise Exposure ▪ Project-related activities could occur seven days per week and will generally be limited to the hours of 7:00 a.m. to 6:00 p.m., ▪ Internal combustion engines used for any purpose in the project areas will be equipped with a muffler of a type recommended by the manufacturer. Equipment and trucks used for project-related activities will utilize DPR-approved noise control techniques (e.g., engine enclosures, acoustically attenuating shields or shrouds, intake silencers, ducts, etc.) whenever feasible and necessary. ▪ Stationary noise sources and staging areas will be located as far from visitors as possible. If they must be located near visitors, stationary noise sources will be muffled to the extent feasible, and/or where practicable, enclosed within temporary sheds.	Duration of Project Construction	Project Proponent and/or Contractor	DPR Construction Manager and/or Inspector	DPR Construction manager will visually confirm in the field that Project Actions are in compliance with NOISE 2. DPR Construction manager will update the MMRP with status and include an explanation of any incidents, actions taken, success of the avoidance and protection measures, and the general condition of the occurrences.		